SCIENTIFIC AMERICAN

GIANT FIGURE OF MERCURY FOR THE GRAND CENTRAL TERMINAL GROUP.—[See page 339]

Making War Photographs from Aeroplanes
Letters from the Firing Line

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

An Inconvenience, Not a Disaster

THE blocking of the Panama Canal by a slide in the Culebra cut is a serious inconvenience, and that is all. In no sense can it be considered a disaster. Colonel Goethals and his corps of engineers have recognized that a certain amount of sliding of the banks of the canal might occur through a considerable period of time after the canal was opened, and the huge dipper dredges, now at work in the cut, were designed to remove these slides. The present slide is serious, it is true, for the channel is entirely filled; but the material is broken rock, easily removable, and the delay until the channel is again opened will not be great.

Such movements are the inevitable result of cutting down several feet into the heterogeneous mass of silted and igneous deposits of which the Panama Isthmus is formed. The material of the cut must find its angle of slope or repose throughout the whole nine miles of the great cut. Every slide brings the inevitable period of quiescence nearer. It cannot be far removed.

The Passing of Permanent Field Fortifications

THE astounding ease with which the fortifications of Liége, Namur, and now of Antwerp, were reduced by the attack of modern siege artillery has brought home the conviction to military men that the day of the defense of frontiers by great forts, such as those which line the French frontier, has passed, probably never to return. There will be division of opinion on this subject, of course; but the comment of one of our army engineers, when he saw the illustrations of the wreck of Belgian forts which are found on page 338 of this issue, "That means that there is nothing left but the mobile field army," seems to us to be very much to the point.

The indirect-fire siege gun of the Germans has obtained the same complete mastery of fortifications, that the direct-fire, high-velocity rifle of the battleship and seacoast fortifications has obtained over armor plate.

When Germany declared war on France her General Staff knew that they were in possession of guns (11-inch or 16-inch, it matters little which) that were capable of biting their way resistlessly through the most modern and powerful forts to be found either on the French frontier or surrounding the city of Paris.

It was well understood that if a smashing offensive carried the German troops close enough to the Paris forts (say within three or four miles) to enable the huge German siege pieces to be emplaced in the rear of the troops and rain down their high-explosive shells upon the French works, it would be possible quickly to cut a pathway through to the city by which the German army could advance and take possession, without investing the city with half a million troops.

Although it is our belief that most of the work of reducing the Belgian and French fortifications has been done by the 11-inch mobile field howitzer, the persistence with which mention is made of a 16-inch siege gun, coupled with information given to us by a correspondent who has recently returned from the French lines, and claims to have seen such pieces in action, inclines us to the belief that a new and special type of gun, based on the principles of the so-called torpedo gun of fifteen to twenty years ago, is now in successful use by the Germans. This gun is probably of an entirely different type, both as to barrel and projectile, from the 12-inch mortar used in our land fortifications. The latter is simply a shortened, direct-fire 12-inch rifle. It uses high pressures in the powder chamber, has a heavy inner tube and heavy reinforcement, and fires a thick-walled shell of great weight (1,000 pounds), capable of piercing armor.

The 16-inch gun is probably a successful development of the Gathmann idea of firing a comparatively thin-walled shell, containing a very large high-explosive filler. Gathmann's idea was that, if a large amount of gun-cotton could be detonated against armor plate, it would smash the plate to fragments. Congress appropriated the money, an 18-inch gun was built, and the gun was tested at Sandy Hook in competition with an army 12-inch gun. The 18-inch shell, containing 630 pounds of explosive, detonated on the plate and left scarcely a mark on its surface. The 12-inch shell, carrying only 60 pounds of Maximite explosive, passed through the plate, and bursting in the rear, tore the heavy steel backing into fragments.

The army officers reported against the gun as being useless for direct attack against heavy armor, which can be penetrated only by heavy, armor-piercing shells, carrying a moderate bursting charge, with walls thick enough to hold the shell intact, in its passage through the plate, and cause the detonation to take place within the ship.

But although the thin-walled shell, with its large cavity filled with an enormous charge, is useless for direct, or horizontal, attack of armor, it is an ideal projectile for vertical attack upon the comparatively thin top surfaces of the Gruson turrets, and the easily penetrable masonry surrounding the turrets. A 16-inch shell of a modified "torpedo" type, with a large cavity, carrying an enormous charge of explosive, could be formed with sufficient wall thickness to carry it, intact, deep into the mass of masonry surrounding and supporting a Gruson turret, or any modern type of mount. The detonation of one such shell provided with a delayed-action fuse, within the massive concrete of the heaviest fort in existence, would account for even such a complete wreck as is shown in the illustrations above referred to.

Now although, as we showed last week, it would be impossible, because of the enormous weights involved, to produce a *mobile* 16-inch gun of the standard type, such as the *fixed* mortars in use in our own coast fortifications, it would be possible to build what might be called a semi-mobile, 16-inch piece for firing torpedo shells of the kind above referred to. Our 12-inch mortar, with its high powder pressure and (for a mortar) high velocity, can throw a shell to an extreme range of eleven miles. To do this the gun has to have great thickness and weight of barrel. But to throw its shell for, say, six or seven miles, the 16-inch gun requires only low powder pressure and a correspondingly less thickness of gun barrel. This brings the weight of the separate parts, barrel, sleeve, carriage, turntable, down to a point which renders them transportable on special carriages over the highways. The gun is not in any sense a field howitzer, for it is necessary to build those concrete foundations of which so much has been said in correspondence from the front, to provide an unyielding base for the turntable or other traversing device of the gun mount.

That the gun, light though it is for so great a caliber, is not a mobile field howitzer, is proved by the fact that a sudden gain by the allied line near Soissons, as reported officially, resulted recently in the capture of two of these guns, which were left behind on their concrete platforms. Had they been mounted like the 11-inch gun recently illustrated in this journal, they would have been drawn to the rear at the first signs of failure of the infantry to hold the enemy.

Rain After Battles

"IT is one of the extraordinary things of warfare," says a recent writer in *Pearson's Weekly* (London), "that a big battle invariably produces rain. We could hardly have a better example than that recorded in 1588, when England was threatened by the great Spanish Armada. After its encounter with our own fleet it was, as we all know, struck by a heavy storm, which completed the work of our gallant seamen."

Once in the early Stone Age somebody remarked to somebody else that rain frequently occurred after battles. The author of this casual statement was probably not a psychologist, else his conscience would have smitten him for having set afloat in the world the germ of a particularly fatuous fallacy. The evolution of the idea was probably complete long before the Age of Bronze. Big battles are often followed by rain. Big battles often *produce* rain. Big battles *invariably* produce rain. Even the modern penny-a-liner cannot improve on the last statement. The myth is fixed—crystallized—and probably imperishable.

Had we enjoyed the privilege of personal acquaintance with the Neanderthal gentleman just mentioned we should have courteously entreated him to start another ball rolling down the ages, to wit, "A big sneeze is often followed by rain." The infinitesimal increase in the humidity of the air occasioned by a sneeze is a simple and obvious fact; whereas the infinitesimal amount of water vapor produced by the explosion of a few tons of ammunition can be hunted down only by an excursion into the fields of chemistry.

Since, however, we must put up with the myth in its present form, let us see how it happens that rain has so often followed battles as to suggest to uncritical people that there was a physical relation between the one and the other.

First of all, no such relation exists. Rain is the result of the active condensation of moisture in the atmosphere, and this is purely a question of humidity and temperature. If the humidity be sufficiently increased, or the temperature sufficiently lowered, condensation is inevitable—provided certain nuclei of condensation (dust particles or molecules of hygroscopic gases) be present; and, outside of the laboratory, they always *are* present.

Now, it is conceivable that a warring army might produce a local rainstorm by setting fire to a great city. If the air be rather moist, a large conflagration invariably builds up great cumulus clouds above it. The heated air rises and cools by expansion, just as it does from the sun-heated earth on a summer day, and condensation results. Under favorable conditions a very big fire might cause a smart shower, or even a thunderstorm, though usually the process goes no further than to form clouds.

A battle, however, cannot be supposed to have any appreciable effect upon either the temperature or the humidity of the air. Two explanations of the alleged production of rain by battles have been offered; one nonsensical, and the other pseudo-scientific. The nonsensical explanation is the popular one, viz., that the condensation of moisture is promoted by the concussion due to cannonading, or that the drops already condensed and constituting the clouds are jostled together by the same process, with the result that they coalesce and fall as rain. As was once pointed out by Prof. Newcomb, the effect of a violent explosion upon a body of moist air a quarter of a mile away is exactly the same as that of the clapping of one's hands upon the moist air of the room in which the experiment is performed, i. e., absolutely *nil*. Or again, if we stand in the steam escaping from a kettle and clap our hands we shall not produce a shower, though we jostle the water-drops just as much as the explosion does at a distance of a quarter of a mile.

The pseudo-scientific explanation is that the gases and smoke produced by explosions increase condensation by increasing the number of "nuclei" in the atmosphere. The nucleation of the atmosphere, as affected by ordinary dustiness, by hygroscopic gases, by radio-active discharges, by ultra-violet light, and what not, is still an obscure subject. An outstanding result of recent investigations, however, appears to be this: The lower atmosphere normally contains more than the minimum number of nuclei necessary for the process of condensation, and this process cannot be made more active by a mere increase in the number. Thus various and abundant nuclei, in the form of gases and smoke, are given off to the atmosphere by great manufacturing centers, yet these places do not have a heavier rainfall than the surrounding open country. Pittsburgh, for example, is one of the dryest places in Pennsylvania. The suggestion that explosions may produce rain by furnishing nuclei to the atmosphere is, in fact, a mere speculation, and probably could be easily refuted by laboratory experiments.

Now if we examine the history of battles and the history of weather we shall find that rain does not always follow great battles, though it frequently does so, and for two very obvious reasons. If, for example, we consult the meteorological records of northern France, where some of the greatest battles in history have recently occurred, we learn that, under normal conditions, rain may be expected in that region about every other day, on an average. Thus at Sèvres, ten miles from Paris, the records from 1898 to 1901 show an average of 157 rainy days per annum. These rainy days did not, of course, alternate regularly with rainless days; but there were generally several rainy spells each month. It is, therefore, evident that the probability of rain within, say, twenty-four hours after a battle, or a dog-fight, is rather high, owing to the ordinary operations of Nature.

The probability of rain after, or during, a battle is, however, materially increased by the fact that the intervals of fair weather between successive rain-spells are normally utilized by commanders in the movements of troops which precede a battle. These movements can generally be effected only in dry weather, and they may require several days. By the time all the dispositions have been made the barometric conditions have changed; the dry "high" has passed on its regular way to the eastward, and the edge of a rain-bringing "low" has entered the *terrain*. Thus a downpour is likely to occur soon after the engagement is well begun; but its cause must be sought in the interplay of forces over which mankind has no control.

Science

To Chemically Cause Paper to Become Transparent use the following solution on the paper: White wax, two ounces; absolute alcohol, fifteen ounces; and ether, one ounce. The solution will be muddy at first, but after a few minutes pour off the clear solution, which is the one to save and use. (Contributed by Loren Ward, Des Moines, Iowa.)

Darkness Before Dawn.—It is proverbial that "the darkest hour precedes the dawn." Mr. W. F. Denning, the English authority on meteors, has recently called attention to the literal accuracy of this proverb, as established by his own observations on thousands of nights. He says: "Before dawn a greater darkness seems to drop down like a mantle upon the immediate surroundings. Objects which were plainly observable during the previous hours of the night are blotted out, and a nervous feeling is sometimes induced by the dense opacity of the air." He claims to have noticed this phenomenon when the subject was far from his thoughts, so that it could not have been purely subjective. He is unable to state the exact interval before sunrise when the remarkable darkness comes on, nor whether it is common to each season and sky conditions.

Ungava, the immense territory which was added to the province of Quebec in 1912, is the subject of a report recently issued by the Canadian Department of Colonization, Mines, and Fisheries, and abstracted at length in a current United States consular report. The annexation of Ungava increased the area of Quebec from 351,873 to 703,635 square miles, making it by far the largest province of Canada. The territory in question embraces the upper half of the Labrador Peninsula, aside from the portion of the latter belonging to Labrador proper. It is a huge plateau, with innumerable lakes (constituting about one fourth of its total area) and a network of streams, which facilitates travel and is capable of supplying unlimited water-power. On the other hand the climate is, over most of the territory, too rigorous for agriculture, nor is there much prospect for grazing. The forests are of some value, and there are supposed to be important iron deposits. The lakes and rivers yield an inexhaustible supply of fish. The value of the Hudson Bay fisheries is still unknown.

The Lowest Organ Note.—A most remarkable accomplishment in the acoustics of music as told by *Science Conspectus*, is the installation of a 128-foot stop in an organ in Lowell, Mass., which produces a tone an octave lower than has ever been known before, and which is indicated musically as CCCCCC. To understand what this means it may be said that a 32-foot pipe vibrates sixteen times a second at its lowest note (CCCC), and this is very near the point below which vibrations cease to form a continuous sound, while a 128-foot pipe vibrates but four times a second when producing its lowest sound. It was found, however, that a group of pipes giving overtones could be arranged to produce, when sounded together, a synthetic tone, and by this means stops producing the effect of a 64-foot pipe have been built without requiring the use of a pipe of that length; and now, in the same way, this monster 128-foot stop has appeared, which is described as "a mighty atmospheric throb of most awesome majesty," indeed it would seem that its tones must be rather felt than heard.

Barometric Pressure and Mine Explosions.—Just what relations, if any, exist between barometric conditions and explosions in coal mines are still unknown, though the matter has been the subject of much discussion and investigation. In England certain newspapers and other unofficial agencies have for many years issued "colliery warnings," generally based on the assumption that a rapid fall in barometric pressure liberates explosive gas from fissures and cavities in the mines, and thus increases the danger of an explosion. Other ways in which the pressure of the atmosphere may be connected with explosions have, however, been suggested. Thus it is possible that high pressure may be more effective than low pressure, by causing slight dislocations of the strata. Again, exceptional dryness of the atmosphere, such as is especially associated with anticyclonic weather, may increase the likelihood of dust explosions. The present attitude of the United States Bureau of Mines on this subject is set forth in recent correspondence with the Weather Bureau. The former bureau does not believe that any particular relation can be established between explosions of fire damp and low barometric conditions. The accumulation of fire damp in old workings is not usual in the mines of this country, while the gas encountered in active workings almost always issues at a pressure far higher than atmospheric—even at several times atmospheric pressure—so that the ordinary fluctuations of the barometer could have no influence on its issuance. In view of the obscurity in which this subject is enshrouded, the Royal Commission on Explosions in Mines deprecated the issue of colliery warnings by the British Meteorological Office.

Automobile

Motor Trucks Must Have Mirrors.—Beginning with January 1st, 1915, all motor trucks in New Jersey must be fitted with mirrors enabling the driver to see the road in back of the truck. The rule was made necessary by the protected position of the driver, who is unable to see behind and to realize when another vehicle desires to pass from the rear. The noise of his own motor drowns the warning signal of the passing car.

New British Non-skid Tire.—A non-skid automobile tire of unusual design is being introduced by the Sirdar Rubber Company of London, England. The tire has a zig-zag line deeply cut into the tread, in which metallic studs are set so that their tops are flush with the tread. The tire is said to be very resilient, and yet as much a "non-skid" as if it were fitted with separate steel studded cover.

Owing to the Total Cessation of Business of Continental automobile manufacturers in England it is anticipated that American makers will experience a decided increase in demand from this quarter; and this will in all probability prove to be a most advantageous opportunity for the builders of electric vehicles, especially in the classes of commercial and municipal vehicles, for which the English representatives of American companies believe there is a very promising field.

New Laminated Tire Fabric.—A new tire fabric is to be put on the market shortly by one of the big Akron tire companies. This fabric is termed a "laminated cohesive interwoven fabric" and was invented recently by L. A. Subers of Cleveland, O. The material differs from the usual tire fabric in that it has no cross weave of any kind, the extraordinary strength of the material depending on the impregnation of the yarn elements with liquid rubber. Inner strains are thus avoided.

Direct Air Cooling of Automobile Engines has always been recognized as ideal, as it does away entirely with radiators, pumps and all the attachments necessary in a system of water cooling; but on account of difficulties encountered in the early days, when motors were crude and the principles were not as well understood, most designers adopted water cooled motors. Still, a few builders persisted in the study of air cooling, and that their efforts have not been in vain is shown by some test runs organized by one of the air cooled machines, when a hundred miles of more than ordinarily hard going was covered entirely on the low gear, which is a fairly satisfactory proof of the practicability of air cooling.

A Crucial Test for Alcohol Fuel.—The unquestioned shortage of gasoline in Germany probably will lead to the universal adoption of denatured alcohol for industrial motor vehicles. For several years past both France and Germany have demanded interchangeable carbureters on subsidized motor vehicles, and Prince Henry's stirring appeal of two years ago "Germans, Use Benzol!" served to impress German motorists and truck users with the fact that gasoline is not the only motor fuel available. The wisdom of the alcohol-benzol propaganda is shown at present in the European war, where Germany is able to look with unconcern upon the complete shutting off of its gasoline supplies. More than 100,000,000 gallons of denatured alcohol are ready for the motor trucks!

"Wireless" Automobile Top in War.—A report from Belgium by the correspondent of an English automobile trade journal tells of a most extraordinary use of an automobile top. It seems that a British patrol succeeded in capturing a German touring car in which two officers were seated. The motor had broken down and the officers were made prisoners of war. In glancing over the car, one of the patrol noticed a wire connection to the "skeleton" of the raised top. Following the wire he pulled from under the seat a telephone receiver and, holding it to his ear, was dumbfounded when he could plainly hear a message coming from nowhere in particular. The top-skeleton formed the receiving wires of a wireless telephone station, and the message came from the nearest headquarters of the army corps to which the officers belonged.

Automatic Garage Door Opener.—Every chauffeur, and perhaps every automobile owner, too, has on some occasion been wont to swear at the closed door of the garage, which compelled him to get out and open it. A Colorado Springs garage employee has just perfected an arrangement by which the automobile desiring to enter or leave the garage, opens the door automatically, and also blows an electric warning signal affixed to the door. The arrangement consists of three metal plates sunk into the ground at both sides of the door. When the front wheels of the car bear down upon the first set of plates in the street, the garage is opened by an electric motor, which also blows the horn at the door. After the car has passed into the garage its wheels bear down upon a second plate, again establishing an electric contact and closing the door. The third plate is for emergencies only, in case the other should be out of order.

Aeronautics

It is Interesting to Learn that all of the English army aeroplane squadron flew under their own power from their base in England to the scene of action in France, where they have taken a prominent part in the work of reconnaissance.

Battles in the Air.—At the commencement of the war many surmises were made as to what part aeroplanes would take in the maneuvers, and battles in the air between representatives of the opposed forces were freely predicted. These predictions have come true, if published reports can be relied on, for it is stated that Vedrines, the French aviator attacked a German machine that was scouting over Paris, and riddled it with an automatic gun with which his craft was armed.

Aircraft in the War.—Although the influence of aircraft in the war cannot yet be precisely estimated, its efficiency has already been apparent, for in many cases there is no doubt but that the strategy of the armies on both sides has been guided by the reports of the air scouts who located the position of every army corps, and gave warning of the points where troops were being concentrated, and in what strength. They have also done excellent work in marking down the positions of the enemies batteries or trenches with such precision that artillery fire could be directed on them without wasting a single shot.

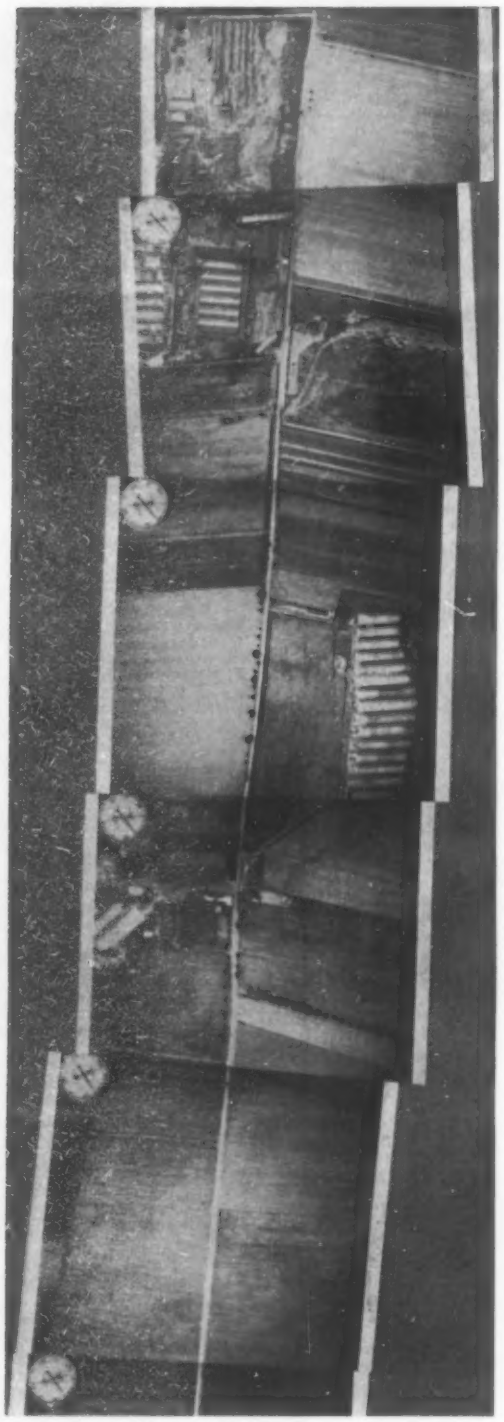
The Zeppelins.—Although but little has been heard of the Zeppelins since the war began, no one seems to know whether their general absence from the field of activity indicates some unforeseen unfitness, or is an indication that they are being withheld with some particular purpose in the future. However that may be, it is a fact that these huge dreadnoughts of the air have not as yet lived up to their reputations. It is most probable, however, that the little aeroplane has so far met all of the requirements, and that the larger craft are being saved for other maneuvers.

The Question of Noise.—A writer in the London *Daily Telegraph* raises a question that has been altogether too generally overlooked in designing aircraft. He says: Whether regarded as a military machine or one used for pleasure, it is evident that from every point of view an aeroplane has everything to gain from possessing a well-silenced engine, and nothing to lose except the fraction of power wasted in the exhaust. Nor is there any reason why an aeroplane motor of the stationary type should not be as effectively silenced as that of the modern motor-car. There is no improvement which would render aviation more immediately popular.

War Aeroplanes.—With a Berlin date an interview with a German military aviator has been published in which many comments are made on what has been accomplished, and the operation of the machines. This aviator had been using a Taube monoplane (recently described in the SCIENTIFIC AMERICAN SUPPLEMENT), and found it underpowered, too slow in rising, and that it was not easy to get off the ground in starting; in fact, it was practically helpless with the lighter and faster French and English machines. On the other hand, he considered the French machines too light for war purposes, were too easily damaged, and were apt to become useless if left out in the open without protection, or in rain storms.

Considerable Anxiety is Felt in London lest it become the object of an attack by German airships, and preparations have been made for repelling such attacks by guns mounted on high buildings; still it is feared that such firing would be dangerous in a great crowded city like London as the shells discharged would be liable to result in considerable damage when they fell back to earth. It is the night attack, however, that is most feared, as then even a big Zeppelin would be quite safe from gun fire. For weeks no lights have been lighted about Buckingham Palace, and of those encircling St. Paul's Cathedral and other centrally located buildings only a few have been lighted, so that their location may not be distinguished at night. Searchlights have been operated at night, but their locations have been changed daily to hide their positions.

Aviation in the United States Army.—Following the act approved July 18th, 1914, creating an aviation section and providing for a fifty percentum increase of pay for both officers and enlisted men, while regularly and frequently participating in aerial flights, and also providing that no person, except in time of war, shall be assigned or detailed against his will to duty as an aviation student or officer, Gen. Wotherspoon, Major General, Chief of Staff United States Army, has by order of the Secretary of War, issued General Orders No. 68, under date of September 17th, 1914. This order referring to the act of July 18th, 1914, describes some of the details to be followed in carrying out its provisions, and suggests that unmarried lieutenants of the line of the army under 30 years of age who desire a detail in the Aviation Section of the Signal Corps should apply to the Adjutant General of the Army, suitable blanks being provided for the purpose.



Aeronautics, London.

Views by the Fabbri Camera.
The several exposures have been matched together to form a continuous record.

Making War Photographs from Aeroplanes

The Fabbri Automatic Photographic Apparatus

By Major H. Bannerman-Phillips, English Aeronautic Correspondent of the Scientific American

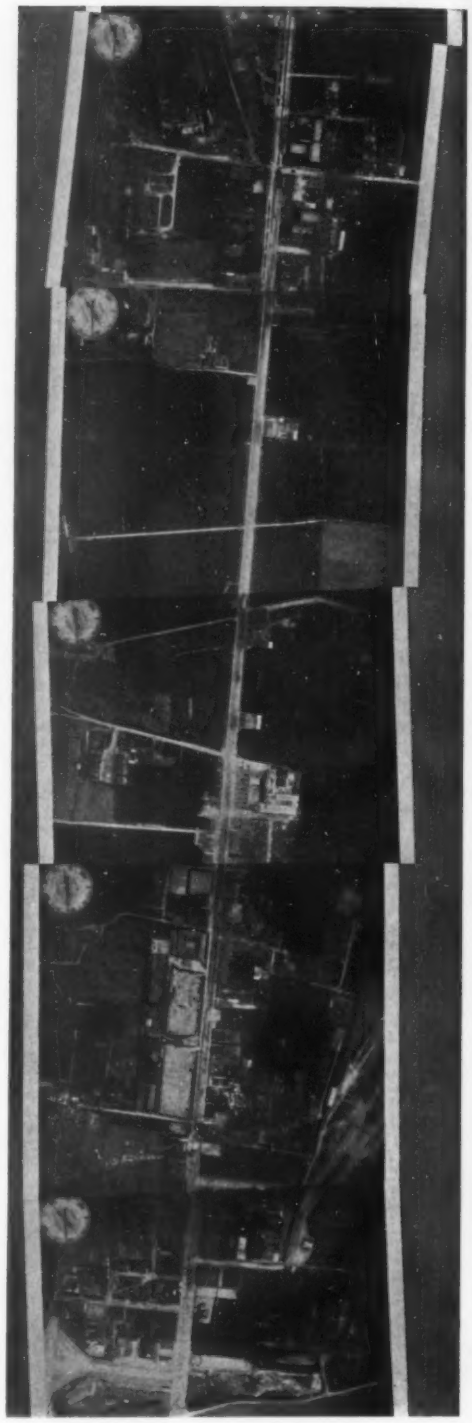
WHEN for purposes of military reconnaissance or to correct maps already in existence of the country which is to form the scene of operations of an army in the field, it is necessary to send out observers in aircraft, photography must be called in to their aid, if detailed reports and representations of the ground are to be furnished. From a height of 3,000 to 4,000 feet objects at the ground level not only look very different from what they would from a horizontal or only slightly elevated viewpoint, since from aircraft they are seen in plan, and the contours are flattened out to all appearance, but the objects themselves often seem so small as to escape detection entirely. This is more especially the case with the observer in an aeroplane, from the pace at which it travels, and from the fact as a platform for observation it is inferior to the airship. Telescopes and field glasses can, of course, be used, but the vibration of the engine in an aeroplane militates against the use of lenses with high magnifying power, even if the observer should be able to examine terrestrial objects while lying face downward and looking through an opening in the floor of the aircraft.

Moreover, when the area to be reconnoitered or surveyed covers several hundred miles, it is a physical impossibility for the human eye, brain and hand, however well they may co-operate, to do the work required and produce a useful and legible record for the information of the higher authorities, within reasonable limits of time.

Science, however, in the person of Capt. Giovanni Fabbri of the Italian Aviation Service, has now come to the aid of the hard-worked staff officer and the airmen of both naval and military services, and has produced an automatic camera, by which a continuous photographic record is obtained of the whole tract of country covered during a flight. There is a double advantage thus secured, in that not only is the observer free to devote his whole attention to the country over which he is passing, but it enables his independent observations to be described later on.

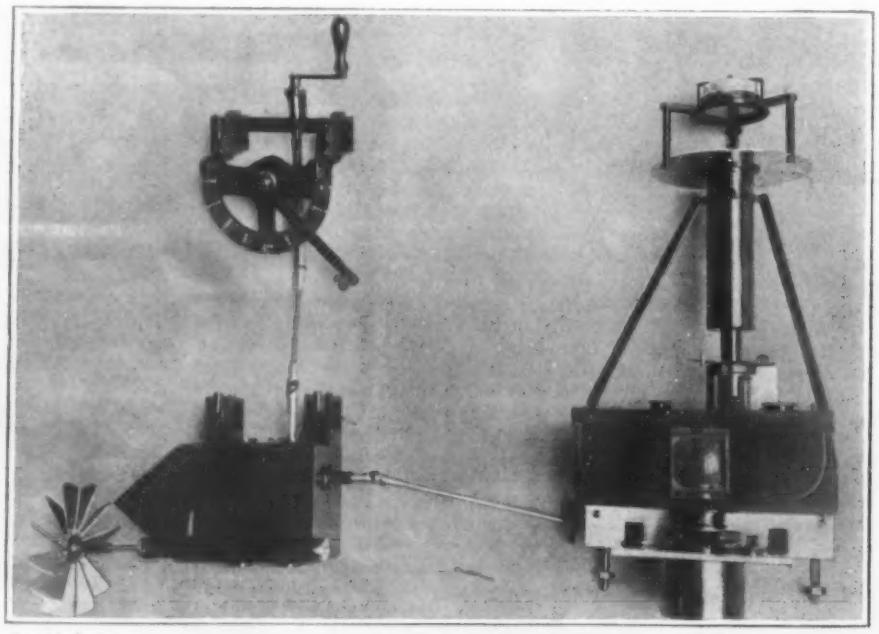
One great merit of the apparatus is its size, and another its simplicity. It can be readily installed in any aeroplane, and while essentially automatic and continuous in its working when once started, it can be stopped at any time and used for occasional single snapshots if so desired.

A rough and ready way of describing the apparatus would be: "a miniature cinematograph." It has a roll of film which winds and unwinds over two bobbins. Along one edge of this film are a series of perforations at stated intervals, and a tooth in the side of the camera presses against the film. When it enters one of these perforations, the film is stopped automatically, the shutter released, an exposure takes place and a snapshot of the terrestrial surface underneath at the time is secured. The unrolling of the film is effected by the rotation of a small propeller, driven by the passage through the air of the aeroplane, which rotation is conveyed by a shaft to a chain, which unwinds the film. The shutter is automatically released at intervals by gearing.



Aeronautics, London.

Views by the Fabbri Camera.
Note that each exposure automatically records the compass direction and altitude.



Aeronautics, London.

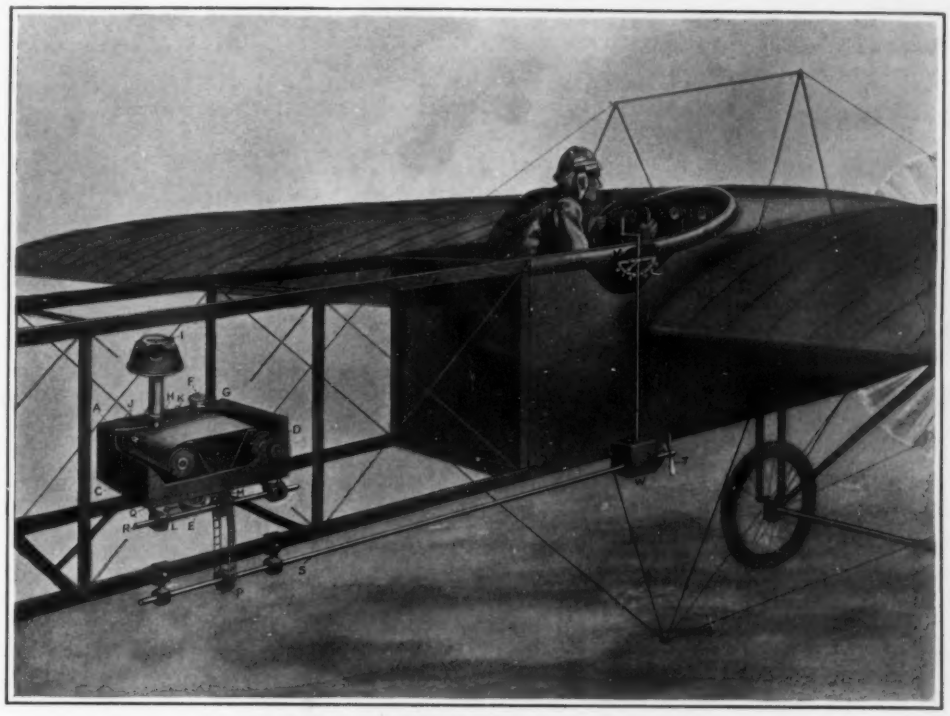
The Fabbri automatic aeroplane camera.

Of course the speed of the film must be regulated in accordance with the pace of the aircraft relatively to the ground over which it is passing, and the velocity of the wind must be allowed for, and there are arrangements for "setting" the machine accordingly. A very important point in connection with the photographic records furnished is that each time the shutter is released the faces of the compass and aneroid are photographed at the same time with the view, and are shown in a corner of the film; and the capacity of the latter is equal to recording at a height of 4,000 feet the features of a tract of country 150 miles in length.

Wireless Telegraphy in the German Army

WIRELESS telegraphy has reached a stage in its development at which it may be said to be fairly well standardized. Three types of wireless stations can be distinguished. There are first the permanent or sta-

tionary wireless plants, second, portable or mounted wireless stations, and third, wireless installations on ships. According to a description given in *Prometheus*, the fixed stations in Germany are located in fortresses and have a range of action of 1,000 kilometers (about 620 miles). All the German fortresses can be placed in communication with the central station at Nauen, and can also receive messages from airships and aeroplanes. The portable stations are assigned to the army divisions. The carriages upon which they are mounted are somewhat similar to gun carriages, and are drawn by six horses. In the case of the heavier wireless stations the crew rides upon the carriage. The operators of the smaller stations are on horse back. Portable stations of the latter type are attached to the cavalry divisions and to those reconnoitering squadrons to which a central reporting bureau is attached. From here all the news collected can then be forwarded to the various headquarters. The heavier stations are placed at the main headquarters and the cavalry division staff quarters. They have a range of about 120 miles, while the light-weight stations have a range of 35 to 45 miles. The stations are used in pairs. When at rest, one of the two stations of the pair is kept in action, while the other is held for reserve. When in motion, they are used alternately, one being in action while the other is being moved forward. It takes about fifteen minutes to set up a station. Dirigible balloons carry only transmitting apparatus, with about one hundred and ninety miles radius of action.



The Fabbri photographic apparatus on an aeroplane.

A, Camera casing; *C*, *D*, bobbins on which the sensitive film is wound; *E*, principal lens; *F*, device controlling tooth *G*, which regulates the making of the exposures; *H*, secondary lens which throws an image of the compass *I* and barometer onto the film; *J*, *K*, *L*, *M*, levers for operating the shutters of the lenses *E* and *H*; *T*, air propeller that operates the apparatus; *W*, exposure regulating apparatus; *V*, lever regulating interval between exposures, which must be set according to height above the ground. Single exposure can be made by means of the small crank handle beside the aviator.

The Strategic Island of Helgoland

IF the sagacious men who are directing the naval policy of Great Britain had been in control at the time when Helgoland was ceded to Germany, it is safe to say that the transfer would not have been made. In that transaction Great Britain acquired from Germany a colonial possession of doubtful value, and in exchange handed over to her a small island at the entrance to the Elbe, which to-day is, next to the Kiel Canal, the most important strategic point in the whole scheme of German naval strategy. The island is small, measuring about a third of a mile in breadth by a mile in length. It consists of the Oberland, standing some 200 feet above sea level, and generally flat on its surface, and the Unterland, a stretch of low-lying shore at its foot. At the time of its acquisition in 1890, the island was subject to heavy erosion. This has been prevented by the construction of sea walls and other protective works. The view of Helgoland which we present herewith shows the low-level portion of the island. The value of the island from a naval standpoint lies in the fact that it is situated about forty miles northwest of the mouth of the Elbe, and in such a position that it commands the approaches to the Elbe, the Weser, and to the great naval base of Wilhelmshaven.

The Germans have done an enormous amount of work in developing the full naval value of Helgoland, and anyone who has not visited the island for a few years would be astonished to see what remarkable changes have been made. The fine bathing beach has been done away with, and a large area of land has been made by filling. The island forms one of the most important torpedo and submarine bases for the German navy, and a fine harbor of refuge has been constructed, together with a large number of concrete-steel buildings, some of which are shown in our illustration in the course of construction. These buildings include artillery depots, magazines and hangars for hydro-aeroplanes, etc., together with the houses for the officers, officials, and workmen employed on the island.

Although Helgoland is still used as a summer resort, only the lower portion of the island is open to visitors. The highland is entirely under the control of the government. It has been very heavily fortified, and the heaviest artillery, both for direct fire and for high-angle fire has been emplaced. The caliber and the number of these guns have never been made public; but the Germans have repeatedly stated unofficially that among the mortar batteries are to be found pieces of 16 inches caliber. It is also stated that 16-inch guns, probably of the mortar type, are mounted on the mainland in the great fortifications at Cuxhaven. The system of defense is stated to be similar to that employed by our own coast fortifications, the whole area of the sea between Helgoland and the mainland and all that area covered by the effective range of the mortars being mapped out in squares, the progress of the enemy's ships through the fields so covered being determined by observation, and the fire of the batteries being concentrated accordingly.

It is possible that some of the 16-inch mortars have been dismounted and transported by rail to assist in the reduction of the Belgian and French fortifications; although, as we explain on our editorial page, we are inclined to think that the 16-inch piece being used in the field by the Germans is a special type of siege gun of lighter weight, firing a high explosive shell of large capacity.

The Franklin Medal

IN addition to other medals which the Franklin Institute has been accustomed to award, it now has at its disposal a new medal to be called the "Franklin Medal," which will be awarded from time to time in recognition of the total contributions of individuals to science, or to the application of physical science to industry, rather than in recognition of any single invention or discovery. This medal will be of handsome design in gold, of a value of about $75, and it is expected that two medals will be awarded each year. This medal is made possible by a donation by Samuel Insull of Chicago.

Some Automobile Developments.—A number of interesting patents have been issued recently for constructions which provide for certain shifting of the cushions and seat backs of automobiles in such manner as to form beds, thus furnishing sleeping accommodations while touring. Whether this will be the accepted style of convertible car, or if other ideas of construction will provide sleeping accommodations, remains to be seen. Touring is becoming more and more popular, and, when occasion requires, facilities accompanying the car and furnishing comfort and shelter at night, should find favor. These may as before suggested include a special construction of the car itself or separate equipments carried like other accessories.

The island of Helgoland, showing the harbor for destroyers and submarines, and the construction of new machine and store shops.

How the War Affects Our Industries

By L. V. Redman

AMERICA leads all other nations as a self-supporting country. This is true either in times of peace or war, and yet, it is now being demonstrated how vastly dependent is the most independent nation in our modern complicated system of civilization.

Chemistry is the least national of all our industries. It is international. Our International Chemical Congresses recognize five official languages — English, French, German, Italian, and Russian, and a first-rate chemist is supposed to read any of the five scientific languages fluently; in fact, it is almost a necessity for a chemist to be a pentalinguist.

The present European crisis is emphasizing how complicated is our civilization, even here in independent America.

For example, the glass industry. Our potash comes from the Strassberg deposits in Germany. Our potash supply is cut off and our glass industry is in imminent danger, for potash is absolutely necessary in the making of all our ordinary glass.

Many of our photographic supplies are imported. The present war has sent the prices soaring. Metol is a substance which has risen in price in three weeks from $3 to $12 per pound, and other photographic chemicals have risen in like proportion.

A common article is carbolic acid crystals. This chemical has risen in price from $8 per hundredweight to $50 and is still rising. Presumably this material is needed as a base for explosives in mellinite and lyddite shells and a disinfectant, and an embargo has been placed on its present export by Great Britain and Germany.

The steel industry is also affected. The iron ores, the coke and coal are all mined in this country, but in the making of manganese steel pyrolusite is necessary, and this chemical has risen in price from $38 to $125, and the supply is limited.

Magnesium oxychloride, from which artificial marble is made, is imported from the Mediterranean. The source of supply has been cut off from the United States, at least temporarily.

Celluloid and gallolith are chemical products in common use everywhere. All the cheaper grades were imported from Europe. The source of supply is completely cut off, and America must look elsewhere for her supplies or have her chemists double and treble their present output.

Almost every dye product has risen in price, although this is unreasonable in many respects, as America makes large quantities of dyes, and while the present conditions may require a rise in prices to pay for the uncertain venture in increasing factories to meet what must be considered as temporary conditions, yet the price is in many respects unreasonable. For example, two dye firms in Chicago were asked to bid on the same day at the same hour, over the telephone, on one of the commoner dyes, tartrazin. The regular price does not exceed 75 cents per pound. One company offered the dye at the regular price, the second company asked $3.50 for one fourth of a pound, and we were told we would have to talk fast to get it at that price, as the demand was very heavy. This reminds one of the talk recently about the necessity of raising prices on beef to protect the customer, consumer, etc.—a rather doubtful form of protection at the best!

Research chemistry is paying its portion also on the increased prices. Jena glass has advanced 30 per cent, as it is imported from Germany, and a continuation of the war means a complete exhaustion of the small supply carried here in America.

Fortunately, we have some chemicals which are distinctly American products, and these jog along at the regular pace and price—alcohol, wood alcohol, turpentine, rosin, acetone, formaldehyde, acetic acid, and wood products generally are holding their own against the menace across the sea.

If the European war continues for eighteen months or longer, it gives the American chemist a rare opportunity to double and even treble his factory's output in order that he may supply the American market with American-made chemicals and stop the heavy toll of $60,000,000 per year, which we are paying to the European chemical market. Not only will we save the $60,000,000, but America will be yet more unaffected in times of peace or war.

The manufacturer may ask what are the chemicals which are so needed at the present time in America and which have been restricted or cut off entirely by the present war.

We buy annually from Europe three fourths of a million dollars' worth of quinine, four million dollars in glycerin, one million for indigo, two fifths of a million for licorice, crude tartarates, two and one fourth million, for carbolic acids four millions of dollars are paid annually to Scotland, Great Britain, and Germany, one million for fusel oil, three fifths of a million in gums, two and one half million dollars for aluminium, potash salts ten million of dollars, four and one quarter millions for platinum.

New Flashlight Signal Apparatus for Army Use

METHODS of signaling at a distance have played an important rôle in warfare of all ages. Modern conditions of military maneuvering have, however, greatly multiplied the importance of this branch of the service. Not only do the great modern armies exceed in point of size those of the past, but the immense range and the great accuracy of modern fire arms have caused a corresponding spread of bodies of troops both as regards breadth of front, and also as regards depth. It hardly needs to be pointed out that the importance of methods of signaling has risen *pari passu* with this broadening of the territory covered by the troops, to say nothing of the influence of modern reconnoitering facilities, notably by aeroplanes and airships.

The new needs have been met, it is true, in a measure, by various of our standard means of communication, after special adaptation for the field work of the army. Wireless telegraphy, automobiles, flying machines, carrier pigeons, mounted messengers, bicycle couriers, the telephone, and semaphore signals all serve their purpose in this field, but all have their limitations also. In many ways the ideal method of signaling is that by flashlight. However, in order to make this method really satisfactory, the beam must be of the form of a narrow cone, or, better still, of a parallel

German military signal lamp and field glass.

pencil of light, in order to prevent any but the proper person from catching the signal.

A device recently designed with these points specially in view is described by Major Faller in a recent issue of *Die Umschau*. It consists of a pair of binoculars over which is mounted a small parallel-beam flashlight. This latter comprises a steel tube *a*, with a socket chamber *b* to which the lamp is attached; a contact box *c* with a push button *d*. This flashlight is screwed upon the binocular at *e*. The battery for lighting up the lamp is carried in a leather case from the soldier's belt. A duplicate battery is also carried in the same case.

The mode of use of this apparatus hardly requires explanation. The flashlight torch is so adjusted, that when a given point is sighted with the binoculars, a beam of light, sent out by the torch upon pressing push button, is directed at the point sighted. Some suitable point is selected as the stationary central, to which signals are sent from the moving observers in the field. These are, if necessary, kept posted as to the location of the central station by flashes sent out periodically in their direction. Except in the immediate neighborhood of the flashlight lamp, the beam can be detected only by persons directly in line with it, unless indeed there are intervening objects in the way. On this account caution is required in using the instrument in wooded regions, for example.

As regards the range of the instrument, it is claimed that under favorable circumstances signals can be sent over a distance of some six miles, though, generally speaking, the range is probably only about one half of this. Even in daylight the signals can be used over a distance of something over half a mile, or considerably farther if the background is particularly advantageous.

A Talk to Inventors on the Oldfield Bill

"No person who obtains a license to use any patented art or process . . . shall be liable to an action for infringement of the patent because of the breach of such license or of any provision thereof."

SUPPOSE that you are the inventor of a process of tanning leather. You make a license agreement with a leather manufacturer who produces only low-grade leather for cheap shoes; you license him to use the process only on that leather; you agree that he alone may use the process on that leather, and accordingly you charge him a royalty of one cent a square foot—a proper and fair royalty in the circumstances. Suppose that you make a similar exclusive contract with another manufacturer who produced only high-grade leather for fine shoes, and that you charge him a royalty of two cents a square foot, again a proper royalty, because, either by adding to the quality or saving the expense of manufacture, the licensee can afford to pay you the two cents and still make for himself a considerable additional profit and give the public better value for its money. If the Oldfield bill becomes a law, that passage in it which stands at the head of this column, will prevent you from recovering against the first licensee if he applies your process in manufacturing high-grade leather. In other words, the Oldfield bill, if enacted into law, will facilitate breach of contracts and encourage dishonesty and bad faith in business.

Again, you may invent a new form of steam engine; you may license one man to make your steam engine for railway purposes, another man for ship propulsion, a third man for driving electric generators, and a fourth for general power purposes. As the patent law now stands, if either one of these licensees invades the field of the other, that is, uses your invention outside of his license, you may successfully sue him on the patent, because he has admitted the validity of the patent. Any court will grant a preliminary injunction. Take away this right, and not only have you lost the benefits which you expected to secure by this division of the business, but you have been party to what amounts to a fraud on your other licensees.

Is there any reason why anybody should ever take such a license under a patent if the law is changed as Mr. Oldfield would have it? If Congress passes the Oldfield bill it would be very much harder for inventors to grant licenses. Manufacturers who wanted the patent only for one purpose would insist on buying the whole patent; otherwise they could obtain no protection in their particular line of work. But such an outright purchase would not only limit the gains of the patentee from his invention, but might tend to deprive the public of the use of the invention in the other fields; for it frequently happens that one concern is not in a position to exploit an invention for all purposes. Consider now this clause in the Oldfield bill:

"No person selling . . . any article of manufacture under a patent shall have any greater right to prescribe . . . conditions limiting the use than if the article were not manufactured under the patent."

Suppose that you have patented a sterilizing process, by which milk can be kept sweet and good and wholesome for three days without injury to its flavor or appearance. The general use of that process all over the country would be something which the courts and the legislature and the public ought to encourage in every reasonable way. You might be doing business in Boston, might use the process in that city, do much good to the inhabitants there, and make some money for yourself; but a man in New York and a man in Chicago and a man in San Francisco might come to you and ask for a license to use that process in these various cities, respectively. It would, obviously, be out of the question for you to carry on the business in every city in the country, and it would be for the public interest that you should put the process into use as rapidly as possible all over the country. You would be perfectly willing to license one man on a reasonable royalty in each of these cities, and in any city, say twenty miles from Boston, but you want to reserve the business in that area for yourself.

The patent might cover a perishable article, an article of food, for example, which had to be consumed within twenty-four hours after it had been made, and you might be selling that article in Boston and be absolutely unable to sell it in any other city. In either of these cases, or in any one of thousands of cases, it may be for the public interest and for the interest of the patentee and the licensee that territorial licenses should be granted and respected.

The paragraphs quoted kill territorial licenses just as they kill licenses for any particular field of work. The Oldfield bill, from this point of view, ought to be entitled "A Bill to Diminish the Returns of Patentees and make it Difficult for them to Derive Revenue by Granting Licenses."

It is easy to draw these general clauses, but hard to see what they mean or to realize the different situations in which they will work harm. For example, it has frequently happened that an extensive, costly research and brilliant invention have resulted in a radical improvement in a machine, and yet the patent was really obtained on some physically small portion of the machine. Such a case was recited in the testimony taken before the committee at the hearings on the first Oldfield bill.

Let us assume, for example, that an inventor makes an improvement in phonographs, the improvement consisting in a new diaphragm, which can be applied to an ordinary graphophone and will result in giving a much louder and much clearer sound, and let us assume that this inventor, either through himself or through a company organized for the purpose, puts the invention upon the market. Now the graphophone sells for from ten or fifteen dollars up to three hundred dollars, depending upon the size of the resonating parts, and there is practically no difference in the diaphragm or the actual reproducing parts of most of these devices. The extra price is put into the larger resonating box and a larger and more ornamental case. The diaphragm would probably cost so little that the inventor would be perfectly willing to sell it for five cents to anyone who wanted it for its legitimate use, that is, for replacing a broken or injured diaphragm of a graphophone purchased from the inventor. But there happens to be several great corporations engaged in the business of manufacturing talking machines and phonographs. Their business would be threatened, and they would naturally try to buy up all the diaphragms they could get and put these diaphragms on their phonographs; that is, they would buy a five-cent article which would be used to double the value of a three-hundred-dollar machine. With the new diaphragm, of course, they could get the business, because they have reputation and prestige, contracts with singers, established channels of distribution and good-will. The one hope the inventor could possibly have of doing a large and profitable business on his invention, resides in inducing the public to buy diaphragms from him, because his diaphragm makes the phonograph so much better. Yet, if the Oldfield bill is passed, the most reasonable and ordinary precautions which he must take to confine the diaphragms which he sells to their legitimate use will be rendered unlawful or their effect will be nullified. This means that the inventor is driven to the existing companies and practically forced to sell the patent for what they choose to give him. None of the companies can afford to give him very much, because it will have no way of keeping the other companies from getting a supply of the diaphragms. The value of such a patent, and the inducement to invent, perfect, and market such devices, will be substantially destroyed. Probably the Oldfield bill was not intended to have this effect; yet that is one of its inevitable effects.

The bill provides that a license shall be granted if the invention is being withheld or suppressed "for the purpose or with the result of preventing any other person from using the patented process, etc., in competition with another article or process patented or unpatented used . . . by the owner of the patent." No one knows exactly what this means, and no one ever can know. Suppose an inventor has a broad fundamental patent which has five years to run and has worked out the invention in two scientific forms covered, respectively, by two separate patents, each of which has ten years to run, and suppose that, after thorough test and investigation, he has satisfied himself that one of these forms is just exactly as good as the other and no better. For manufacturing reasons, under these circumstances he would make only one of the two forms. On the assumption made, why should the patent owner be required to grant any license whatever? Suppose he is required to grant a license. What license shall he be required to grant? Will it be merely a license under the second of the two later patents, the one which has ten years to run? Surely it is not the intent of those responsible for the bill that this should imply a license under the broad patent, and surely a man should not lose his exclusive rights under a broad patent because the invention of the patent can be embodied in two or in twenty devices, and he does not make them all. If the license were granted only under the second patent, the one which had ten years to run, that license would for five years be absolutely useless to the licensee, because the first or broad patent would prevent him from using the invention.

Another case to be considered is the common one where the broad patent shows the device in a very imperfect form. An instructive illustration was the original Bell telephone patent. This patent was good and valid and was sustained by the Supreme Court of the United States over and over again, but the telephone disclosed therein was so poor that it would scarcely talk and was utterly uncommercial. Bell and his assignees improved on the original patent, and others improved. The telephone company bought the patents or took licenses under them, and finally were able to make the telephone of commerce as it existed, say, fifteen years ago. This last telephone was different in appearance, even in principle of operation, from the original telephone, but it came under the broad patent because it utilized the broad invention. The company "suppressed" the original telephone of Bell because it was inferior. Is it the intent of the Oldfield bill that in these circumstances an outsider shall receive a license to make this original Bell telephone, or any one of the hundreds of different forms of telephone which the Bell Company, one after the other, developed and abandoned for something better?

If this is the policy of the law, there would be a restriction not only on invention, but on the disclosure and utilization of the invention. If, under the circumstances, the Bell Company had a satisfactory and workable telephone, and one of its employees should invent a much better telephone, the Bell Company's lawyers would advise it that should it patent and market the better form in substitution for the existing form, the existing form would be open to all its competitors under this compulsory license provision. Surely under these circumstances the Bell Company, if actuated by selfish motives, would order this inventor to forget the invention, would refuse to let its research department develop it, would not give it to the world in a patent, but would suppress it forever, if posible.

Experiments Upon Concrete

THE surface of concrete is frequently treated by the use of the pounding rod with enlarged circular end, so as to compress the material at the surface. Such compression has quite an influence on the strength of the concrete, so that in order to have uniform quality over a given surface, it is required to give the same number of strokes of the rod at all places. Tests made with a mechanical pounding device were quite conclusive; for instance, using 60 strokes and 40 strokes, the corresponding figures for strength were 201 and 108, while hand-molded concrete without pounding showed only 66. Applied force is of less effect than the number of strokes, but this number must not be exaggerated, or else the denser materials are forced into the lower parts of the layer and the mass is no longer homogeneous. A workman can give 50 strokes of a 30-pound tool per minute under best conditions, but the work is not constant during the whole day, as the effect in afternoon falls below that produced in the morning. As hand labor fails to produce concrete of uniform strength, this led to the invention of a pneumatic tool by which the pounding can be easily regulated and is quite uniform. Such a hammer can give 300 or 400 strokes a minute on the larger surface, and the workman confines his efforts to sides and corners of the work. A plant of this kind is a simple one and comprises a motor-compressor, piping, and the pneumatic tools, the pump group being mounted on a small truck. Per 10-hour day, 100 cubic yards of concrete are treated, using 8-inch layers, and for large work this cuts down hand labor about 80 per cent.

The Current Supplement

IN the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2025, for October 24th, there will be found a short description, together with a number of illustrations showing some of the details of the big passenger steamships recently built that enable one to gain an idea of their great size. An article on Modern Research in the Metallurgy of Iron gives valuable information about this indispensable material, and also treats scientifically of the composition, properties, and characteristics of steel. Extracts from the address of the president of the Geographical Section of the British Association on Man as a Geographical Agency review what man has done in recasting the geography of the world. Some Recently Discovered Nubian Antiquities describes and illustrates the finding of many articles that add much to our knowledge of the history of Egypt. The Electrically Driven Gyroscope in Marine Work tells of a few of the valuable applications of an instrument that not so long ago was merely a scientific toy. The Origin of Waves, a description of an instrument that automatically calculates the dead reckoning of ships and other readable articles make up an attractive issue.

Motor River Boats in France

A NEW type of motor craft is now in use on the Saone River near Lyons, it being built for the Lyons Navigation Company. The dimensions of such craft are such as to allow them to run in the standard canals, or 125 fept length by 16 feet width. Power is obtained by the use of a crude oil engine of 40 horsepower, and boats of the present kind will take a net load to 230 to 250 tons freight. Should the proposed river improvements be extended to Paris, such boats will ply between that city and Lyons and will do excellent service.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Triumphant Struggle With a Beetle

To the Editor of the SCIENTIFIC AMERICAN:

In your number of February 28th, 1914, I read with much interest an article entitled "A Triumphant Struggle with a Beetle," by H. J. Moors, and I am sending to you under separate cover two or three papers which give the result of our work here in Trinidad with this same fungus as a means of control for the froghopper, which is the most serious insect enemy of the cane plant in this island. Although this fungus has been known as an insect parasite since 1879, it is only within recent years that it has begun to play an important part in insect control, and it promises to be of great value, especially in the tropics, where our conditions of temperature and moisture are much more favorable for fungus growth than in temperate zones.

Since the publication of our first paper in 1910, giving methods by which this fungus can be successfully grown, we have had requests for cultures and spores from practically all over the world, and now the fungus is being tried out as a means of combating a number of insect pests in different places. Although by no means an absolute method of control, the use of this fungus, together with better methods of cultivation, promise to keep the froghoppers well within bounds.

JAMES BIRCH ROBER,
Mycologist, Board of Agriculture.
Port-of-Spain, Trinidad.

Misinterpreted Wireless Signals

To the Editor of the SCIENTIFIC AMERICAN:

In your issues of May 16th and June 6th, 1914, are letters discussing misinterpreted wireless signals, following up more or less scientific discussion of the use of the "S O S" signal.

I have yet to see any noteworthy writing on the subject which takes into consideration the human element, best expressed by the now famous phrase, "The man behind the gun."

On the large railroad systems it would be thought somewhat unusual to put a track-walker on as engineer of one of their up-to-date engines.

But many wireless operators are working to-day who are as much out of place as the latter would be.

These men are licensed, but many of the licenses are issued by officials who themselves are not telegraphers, and who are absolutely incapable of judging the applicant's qualifications. There are army officers in this territory authorized to grant such licenses, and who are wholly unable to judge of the applicant's fitness.

And the examinations prescribed are stereotyped matters that any man may pass after a little "cramming" and still be entirely unfit for the work.

Men are licensed directly upon leaving some school, or after amateur practice, and given responsibility for the lives of hundreds of trusting victims; but these same men would not for a moment be employed by a railroad and given responsibility for their more (?) valuable property.

And such officials as the above give licenses, stating that certain men are telegraphers. How did the official find it out, if the men are?

How *could* they find it out, knowing nothing of the subject themselves?

Among American telegraphers there is found the use of the word "operator," in a purely technical sense, as distinguished from the word "operator" as used in ordinary writings. The real telegrapher never uses the word "operator" in the latter sense. It is not recognized in his vocabulary. When he does use "operator," he refers to a capable and experienced man; master of his trade.

These men laugh among themselves about such errors as that of a man who is trying to make the combination "M B S" and succeeds in making it sound like "S O S." This error was not the result of accident; it was simply gross inefficiency. Such a man might easily distort a dozen combinations into "S O S."

Instances can easily be found of ships traveling at sea for days, unable to communicate with any other station, simply because of the inefficiency of the "man behind the gun," while hundreds of passengers dependent upon him for safety sleep or eat in fancied security, protected by stringent (?) laws.

Why is this?

One reason is to be found in an examination of the rate of pay given these men, which is ridiculously small for a skilled trade.

A little investigation and legislation having to do with the personnel of the wireless service might accomplish something.

H. B. JOSEPH.
Fairbanks, Alaska.

Letters from the Firing Line

By an Officer in the French Army.—Special War Correspondent of the Scientific American

[The author of these letters is an artist as well as an officer, and the accompanying sketches are from his pen. Naturally his emotions over the damage done to the Cathedral of Rheims are very intense and the destruction is described most feelingly.—EDITOR.]

IT has been raining incessantly for several days, and the nights are very cold. The beginning of this autumn strangely recalls that of 1870. In that year, from the middle of September, the frost began to torture our troops—a terrible year in every sense, one which abounded in misery for everybody. Of course, it is not possible to establish the lease resemblance between our brave but poorly equipped army of that time—the army of the empire—and our admirable army of to-day—the army of the republic. The suffering from the cold is greatly to be dreaded; for pleurisy and bronchitis, which may visit the soldier, are just as deadly as the exploding of the shells or the rain of bullets and the thrust of bayonets. All precautions have been taken, and each of us is in a good condition to withstand the first cold.

Is there any man living whose imagination can evoke the enormous and formidable battle that spreads from the extremity of the Ilede, France, across the boundary of Champagne? It is not a battle of men, it is a battle of giants, and there is no record of anything like it in all history. For ten days two furious and tragical masses of humanity that has lost all feeling of humanity have thrown themselves against each other with an ever increasing violence. On the enemy's side there is a solid iron wall of obstinate troops frozen by a terrible discipline, which will break to pieces one day. The Allies' side is a battering ram hammering away without cessation and directed by an unseen and unparalleled hand which is moved by the soul of patriotism. It is the cord of the human energy stretched to the breaking point, although the sun-burned and toughened faces show beneath their apparent placidity an indomitable resolution. The pen of Tennyson writing the "Charge of the Light Brigade" could only give the slightest idea of this terrible shock—a terrible and gruesome vision which surpasses in imagination Edgar Allan Poe, Shakespeare, Dante. The human eye which has looked upon such things as these can never forget them, and the image of it will be stamped in his memory as the very climax of horror until the tomb closes over him. What I have seen on the battlefield will remain pictured indelibly in my mind until my dying days. Nature herself, with her storms, earthquakes, volcanic eruptions of burning lava, and clouds of smoke, never produced a more stupendous chaos and never opened a deeper sepulchre than this incalculable artillery which for many weeks has roared and spit shells upon a front of 200 kilometers, from Saint Quentin to the Argonne.

To-day they are cleaning up the battlefield. The corpses have been picked up and placed in a row, while the men, their nostrils plugged with cotton saturated with a disinfectant, are digging the ditches to receive the dead. The Germans, when they do not inter their dead in trenches, pile them in a heap, cover them with straw, pour kerosene on them, and burn them. A terrible odor, an odor of decayed meat, mounts from all this putrefaction. It grips our throat, and for days it sticks to us. While I am writing these lines I smell it still thick around me. In vain the wind blowing in gusts across the plain tries to sweep it all away. It succeeds in dissipating the swirls of smoke which rise from all the burning stakes, but it cannot drive away the odor of death.

The nearer we approach the *plateau de sezanne* the more evidence we have of the precipitance of the German retreat. A Taube aeroplane pierced with shells and shrapnel fell on the left of the road; nothing remains but the frame. Dead horses, swollen and hideous to look at, are scattered about the roads of the retreat, which are still littered with straw taken from the neighboring fields, and upon which the exhausted troops of the enemy had rested a few hours.

The Germans retreated so quickly toward the north that they left behind a mass of shells inclosed in willow baskets, together with thousands of cartridges, helmets, etc., and in addition to these military remains there were empty bottles of champagne and innumerable portefolios and pocketbooks torn open and empty. Along the road the telegraph wires are all cut and the poles are pulled down. The track of the railroad has suffered little, but I cannot say the same thing for the dwellings—smashed in, riddled with balls, torn by shells, broken windows. Sometimes, as the hazard of war decreed, beside a house that is entirely destroyed another dwelling will be standing intact with the curtains still hanging at the window, and a pot of bright red geraniums blooming on the sill.

In a barn a Saxon ambulance is put up. Twenty or twenty-five Germans are gasping in death throes upon miserable pallets. Two army surgeons are dressing their wounds. One of the Saxons is naked and kneeling. The surgeon is sewing up his back, baring pieces of his flesh. Speechless and coldly I looked upon this horrid spectacle. The enemy surgeon tries to excite my pity. "See," he says to me, "our poor wounded ones." "I have seen as pitiful a sight among our men," I replied.

A more appalling sight is that of the abandoned dead left without burial, and that of the wounded lying helpless on the roadside and in the ditches. Our ambulances gathered up the wreckage of the retreat.

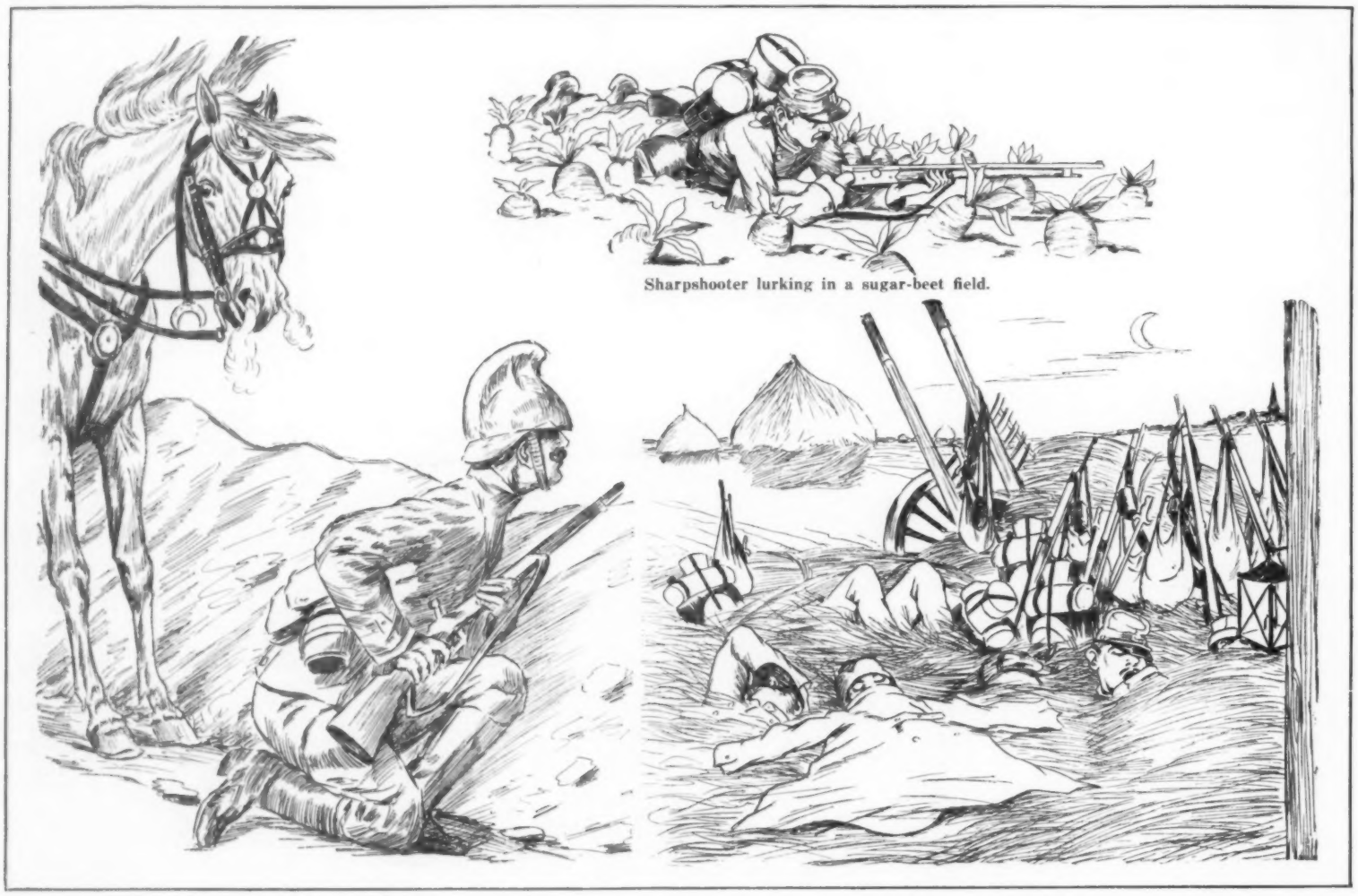
Farther along the road there defiles in front of us a convoy of prisoners, horsemen, infantry men in khaki costumes; they are tired and thin, with hollowed cheeks, marching as if they were drilling and conducted by French mounted police. They have just passed before a big train of their automobiles which a detachment of our own cavalry had surprised and destroyed. The tanks of flaming gasoline had consumed all the framework. The armature alone is left all tangled up and twisted on the border of the hill, and beneath the blackened branches of the trees which the flames have attacked.

The artillery duel roars incessantly between the hills that frame the valley. The mass of the infantry, which is admirably protected by our good guns (seventy-five) continues its advance under the rain of shells which plough the soil, digging large furrows in the ground—the grave of many of the soldiers.

Night has fallen, and with it silence. An odor of blood, of fire, and of death hovers now upon the darkened fields.

* * * * * * * * *

The Cathedral of Rheims is in flames. I cannot speak of anything else to-day. It is a stab at the heart of



Sharpshooter lurking in a sugar-beet field.

French dragoon scouting.

Bivouac on the allied line.

France, a direct and cowardly insult thrown at her face. The burning of Louvain, the destruction of the university where centuries had heaped their treasures, already appealed to the world. This is a still worse act of vandalism. The enemy set fire to the most magnificent fane of Christianity while invoking the Christian God. In so doing they have covered themselves with an immortal shame, and it will be hard for Germany to eradicate this deed from the memory of all lovers of art. They bombarded Rheims and I was there. As we were coming back from Epernay we saw Rheims ten miles away. On the background of the sky the cathedral was silhouetted in all its majestic lines singing for the last time its poem of stones. Our eyes were riveted upon it. We advanced. An officer, field glasses in hands, nudged me brusquely with his elbow: "Look there," he said, "it smokes!" It was smoking and we quickened our steps. The dirty gray clouds were rising behind the towers. We could hear the noise of the bombardment. We halted. From a mound we saw the smoke spread in the sky; the first red glow was appearing above the horizon.

All of us understood. It was the cathedral that was burning; my heart stood still and my artistic sense made me comprehend in a moment the irreparable greatness of the sacrilege. As an artist, I had so often admired this most beautiful piece of stone lacework of the world. I am so familiar with the six hundred statues which form the "spiritual garrison" of this majestic edifice. It is not only as a Frenchman that I mourn its loss, for the art-lovers of all humanity have a claim in the possession of this jewel of architecture. Rodin has said: "The artists who have built the cathedral gave to the world a reflexion of divinity." Yes, I had the infinite sorrow to watch the destruction of this masterpiece. Oh, the barbarians!

We filed along toward the city. The flames spread. Two miles before reaching the city we slackened our pace, because here comes an exodus of the citizens—the women, the children, the old people are fleeing from death. It is 6 o'clock; the night falls. On a red and trembling background like a curtain that is being shaken, the cathedral seems to stretch its whole body toward the sky as in an ardent prayer. It seems to be returning its soul to God.

We passed *la Vesle*. The night has almost descended. The shells are violently exploding in the streets and on the roofs. We reached the cathedral. The *parvis* (the square) is torn in many places. We cannot see what harm has been done to the cathedral, because it is too dark. Moved by a feeling of love, and as though we could protect it, we climbed upon its porch. Night has now come. They are still firing.

Eight o'clock—all is silent. We have no lodgings; we will spend the night near the cathedral.

For many hours we sat on the steps, getting up from time to time to while away the minutes. All of a sudden we heard a great crash, and the earth shook. The first shell had fallen upon the city. It was 25 minutes past 2 in the morning, and this shell exploded on the cathedral square. A second shell followed immediately, dropping a few steps away from the first. It was the beginning: the Germans had rectified their faulty aim. This time they had the cathedral in their grip. We stopped counting the shells, they fell continually. We left the cathedral. A few minutes afterward we saw the first stone fall. It was the 19th of September, early in the morning.

Between dawn and sunset more than five hundred projectiles were thrown upon Rheims. An entire quarter of the town was the prey of flames, and in most of the streets we saw nothing but burning houses. There is nothing left of the sub prefecture. Seven shells burst before the *hotel de ville* (town hall). At this moment the cathedral received an immense wound in its roof. We were back again. The shells, which had succeeded one another regularly and without interruption, had made a breach in the walls of the noble church. The sorrowing blocks of stones which had valiantly resisted the storms of many centuries fell with a terrible crash.

The cathedral is almost entirely destroyed. The roof has fallen in, the rest is still burning, and we can see only the walls through an immense cloud of smoke. The cathedral was surmounted by the Red Cross flag—there were indeed some wounded inside, and especially Germans; but this, like some other of our hospitals, the enemy did not respect. All of these wounded would have been burned alive if several army doctors had not hurried in to rescue them and take them into a neighboring museum.

Night came, and the huge red illuminosity coming from the blazing furnace rose in the dark sky. Without any military reasons the Germans have shelled mercilessly the cathedral of Rheims and destroyed it. In their disappointment not to be able to annihilate Notre Dame of Paris, they have vented their anger upon Rheims.

The German generals and the Emperor issued a declaration of war against all that is greatest in the world, when they turned their guns on the place where Clovis embraced the Latin civilization. This metropole of S'Remy, unique marvel of art, where lived in the sacred stones, under the great statue of the Christ, a whole world of saints whose martyrdom was renewed by the fire of the German shells! God himself hovered over this cathedral of Rheims, the heritage of all those who professed Christianity. When I saw them so close to Rheims I thought "they will not dare to touch the cathedral." I thought that when they aimed their guns something would cry to them in their hearts; that this church was sacred and not to be violated; that it was the parthenon of art, and the property of the world!

But they have done it. Nothing has held their hands back. We cannot say as the Christ on Golgotha: "Forgive them for they know not what they do." They did know. They knew very well the great artistic and moral value of this master work which they have destroyed. They knew every stone of it; for the German army as well as the French is composed of every class, including the savants and the artists.

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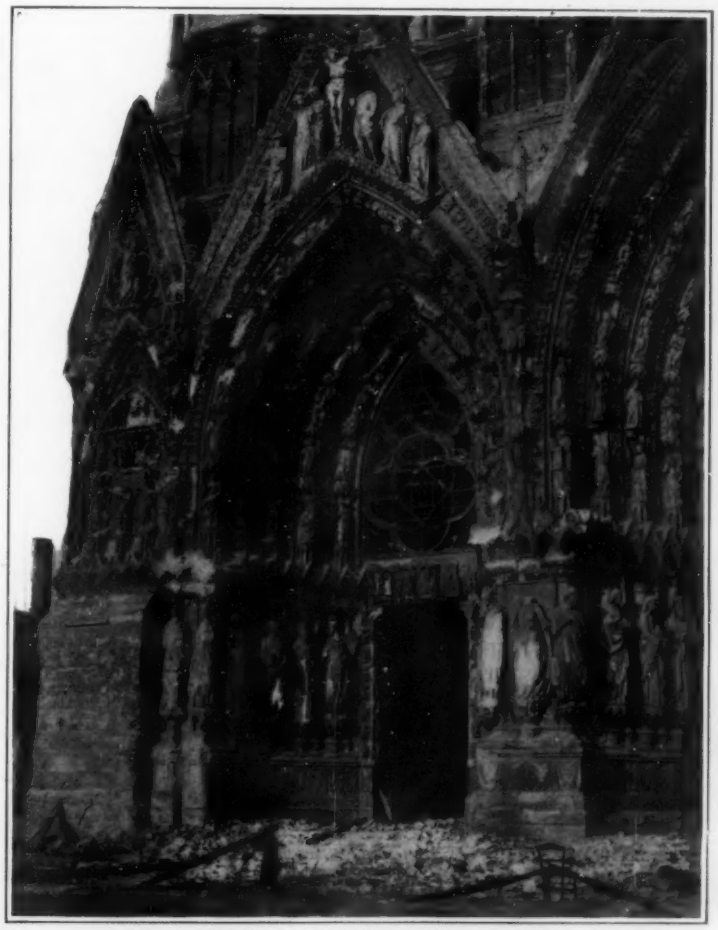
Damage done to the roof of Rheims Cathedral.

This shows upper surface of stone vaulting. The timber roof was entirely consumed.



Front of Rheims Cathedral after the bombardment.

Many carved figures were seriously damaged and can be seen headless in the photograph.

A Caoutchouc-like Material Made Out of Fish

A WELL-KNOWN German chemical weekly tells of a process for making a very elastic, caoutchouc-like material out of salt or fresh water fish. The process in brief is as follows: 100 kilogrammes (about 220 pounds) of fish is treated with 400 liters (about 110 gallons) of water for two hours at a temperature of 90 deg. Cent. (about 194 deg. Fahr.). The aqueous extract is then freed from the solid residue by filtration, and a test is made with a small portion of the filtrate to determine how much dilute sulphuric acid, or sulphurous acid in gas form or in aqueous solution is necessary to precipitate completely the lecithin containing albuminous bodies which are precipitable by acids. The necessary amount of acid, as calculated from the test, is then added to the filtrate, and the precipitated albuminous bodies are then removed by filtration.

The clear filtrate obtained in this manner is treated with a concentrated solution of barium hydrate, which has been warmed to a temperature of 50 deg. Cent. (about 122 deg. Fahr.), until a plainly perceptible alkaline reaction is obtained. In place of the barium hydrate solution a dilute aqueous suspension of calcium hydrate (milk of lime) may be used. Immediately after this the whole mass is treated with carbonic acid gas, until it shows a weak acid reaction. The barium of lime precipitate is removed by filtration, and the filtrate, to which formaldehyde has been added, is concentrated in vacuo. During this evaporation, traces of free carbonic acid escape, and the resulting product represents an elastic mass, not unlike caoutchouc in its properties.

A Mountain of Rock Salt.—A mountain of rock salt, 300 feet in height and nearly a mile in diameter, is described by Prof. E. F. Gautier as occurring near Jelfa, Algeria. Two other hills of this character are known in Algeria, both being near Biskra, and in all cases the salt is surrounded by Triassic marls and clays. A curious feature of the Jelfa Hill is the fact that in spite of the very soluble character of the material composing it, it stands up in high relief from the surrounding clay, and contains no valleys or other signs of erosion. It does, however, contain a number of sink-holes, as in a limestone country. When the brief torrential rains of winter occur, the water sinks almost at once into these cavities and soaks through the permeable salt, emerging at the margin of the hill in salt springs. The same showers falling on impermeable clays and marls produce a maximum of mechanical erosion, so that these substances are worn away, leaving the salt in high relief.

Strategic Moves of the War; or the War in Europe

Letter from the Military Correspondent of the Scientific American, October 17th, 1914

THE capture of Antwerp on October 9th is the most important event of the month in the campaign in France. While maintaining her position along all the rest of the line, Germany has been able to achieve a gain in Belgium that will materially aid her general plan of operations. Antwerp's inner line of defense consisted of fifteen forts, of which the major portion were constructed in the decade following 1860 according to the plans of the noted Belgian military engineer, Gen. Brialmont. The increase in the effective range of artillery and the growth of the city had rendered this line of forts too close to the city, so that much discussion was carried on in the Belgian legislature chambers during the last twenty years as to the need of a new line in order to hold an enemy off at a greater distance. This plan was finally accepted, and the forts were authorized as funds permitted. At the outbreak of the war the defenses were completed on the south and east except for some items of ordnance, which it was claimed that the Krupp works had purposely failed to deliver.

While their main armies were prosecuting their campaign in France, the German garrison of Belgium constructed a line of field works covering the front of the southern and southeastern forts of Antwerp, and under this protection they constructed emplacements for the fire of their big 11-inch field howitzers. When everything was ready to furnish a powerful artillery bombardment to support the assaults of attacking columns, the army for this purpose was assembled.

So far as its caliber is concerned, the 11-inch howitzer is not a new piece of ordnance; for eleven inches is one of the standard calibers for the permanent coast defense of European nations. We employ an even larger caliber in the 12-inch mortars, with which our coast forts are armed. But up to 1904 the five-ton 7-inch field howitzer was considered the largest gun that could be moved readily enough for use in siege works. The Japanese started their bombardment of Port Arthur with this type; but found progress so slow that they attempted the unprecedented feat of bringing up several sea coast 11.2-inch (28 centimeters) howitzers. This was accomplished after much time and labor, and in the fourth month of the siege these heavy guns started their fire. The Russian forts were built to withstand only the bombardment of the lighter shell, and were gradually destroyed by the powerful explosions of the shells from these guns. After the bloody battle and capture of 203-meter Hill the Japanese used this as a lookout point to check up on their fire on the Russian battleships, and then, by the fire of these big mortars, forced the sinking of the warships in the harbor.

High-explosive shells bursting deep within the emplacement have completely inverted this gun and its turret.

The Germans profited by this example and set to work to design an 11-inch gun for transportation over metaled roads. While this last meant a large increase in mobility over the previous rail transportation, it also required a reduction both in total load and in unit load on the wheels. By using moderate charges of slow-burning powder (the so-called smokeless), which makes it possible to secure good ballistic results with low pressures in the gun, the strain on the gun was reduced so that less metal was required. The development of modern gun steels of increased tensile strength permitted a further reduction in the thickness of the gun cylinder. By all of these modifications a gun was developed that weighed considerably less than the one used at Port Arthur.

In order to divide the weight for transportation, the gun is taken out of the frame and is carried on a specially constructed truck, while the carriage is provided with wheels and is transported as a separate piece. The wheel pressure on the roadway is brought within safe limits by providing a broad tire of linked plates similar in principal to the caterpillar traction engines used in soft ground or sandy districts.

When firing a 484-pound shell, with a powder charge of 22 pounds, this howitzer has a range of 10,000 yards, or six miles. When firing its heaviest projectile, 760 pounds, with 16.5 pounds of powder, the range is 7,000 yards, or four miles.

The effectiveness of the fire of these heavy guns is due to the large charge of high explosive contained in their shells, about one sixth of the total weight. Fortifications are, for reasons of economy, proportioned to withstand the heaviest ordnance that is expected to come against them. When, as in this case, an unusually powerful bombardment is brought to bear, the roofs and walls of the bomb-proofs and casements are blown in, and the guns of the defenders are put out of action.

It was by such tactics that the Germans scored their successes against the Antwerp forts. By the bombardment from the south, Forts Waelham, Wavre, Konigs-

(Concluded on page 341.)

This photograph seems to prove that "there is nothing left but the mobile field army."

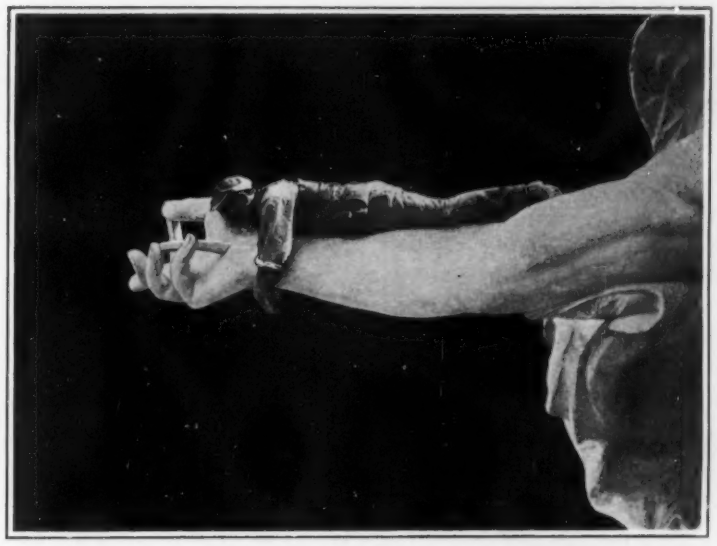
The Colossal Group on the Grand Central Terminal in New York City

ASSEMBLED above the façade clock of the Grand Central Station in New York city is a stone group, which, to the spectator on the sidewalk below who glances up to note the time, must seem little more than life size, but which nevertheless weighs something like 1,200 tons. That spectator will find it difficult to realize that the height of the central figure is 28 feet and that the diameter of the clock itself is thirteen feet.

But while the colossal proportions of the group may be lost upon him because of the vaster dimensions of the building upon which it is mounted, its singular beauty, symbolizing the purpose of the Grand Central station, must surely make its appeal. The station is a modern gateway to a modern city. Like the gateways of old, cut in the walls or fortifications of a city, it seems fitting that it should be topped by a group which visualizes the purpose of the structure which it adorns. The Grand Central terminal is a commercial building, a portal through which multitudes pass to and from the busiest commercial city in the western hemisphere. Hence, it was decided by Messrs. Warren and Wetmore, the architects, that the architectural composition of the station should consist of three great portals crowned by a sculptural group, the whole to stand as a monument to the glory of commerce as typified by Mercury, reinforced by physical and moral energy in the persons of Hercules and Minerva.

The task of carrying out this idea was entrusted to Jules Coutan, who is a member of the French Institute and who is considered by many the greatest decorative sculptor of our time, that is, in work where the human figure is to play an important part in a public monument. After Coutan had completed his preliminary work, the group was executed in stone in this country in about six months. This extraordinary rapidity was attained largely because pneumatic chisels were used by the workmen, and because the plant in which the group was sculptured was furnished with every modern mechanical convenience. Under ordinary conditions it would probably have taken about eighteen months to finish the group.

How well M. Coutan has lived up to his high reputation is apparent from the skillful handling of the entire mass as a decorative *motif*. The clock and the human figures above it blend together in a harmonious *ensemble* which is rarely attained in American monuments.



The arm of Mercury is 11 feet long.

The colossal figure of Hercules, one of the three figures in the group which surmounts the clock on the Grand Central station.

The group is 150 feet from the sidewalk. The central figure, Mercury, is 28 feet in height, and the wings of the eagle behind it measure 35 feet from tip to tip.

The heroic sculptural group, designed by Jules Coutan, which crowns the Grand Central terminal station in New York.

Alloys Developing Hydrogen by Contact with Water

IN these days of ballooning, the rapid and cheap manufacture of hydrogen gas is of great importance; and even processes which do not effect the desired result on a commercial paying basis may be of use in directing experimenters toward profitable lines of research, or from those which would prove useless.

Among other processes, there is one by which a considerable number of metals develop hydrogen when in contact with acidulated water; the oxygen set free at the same time being lost. This process, however, has not the advantage of those in which electrolysis is employed, and which permit collecting the oxygen at the same time as the hydrogen.

But now there comes to the front a process, discovered by a Japanese named Sadamasa Uyeno, in Tokyo, by which a certain alloy, plunged in hot water, develops hydrogen from this latter at the rate of 1,200 to 1,500 cubic centimeters at atmospheric pressure to one gramme of this metal. A practical mixture for this purpose consists of 40 parts by weight of aluminium, 7 of zinc and 3 of tin; or to put it in percentages, 80, 14, and 6. The aluminium is melted in a crucible, which is then removed from the fire; the zinc and tin are added simultaneously, and all well mixed; upon which the alloy is cast into suitable slabs.

As the melting points of zinc and tin are lower than that of aluminium, and the amounts of these two metals are comparatively small in comparison with that of the aluminium, it is not necessary to put the crucible a second time in the fire, as the newly added metals melt immediately. Thus there is comparatively little oxidation and evaporation of the metals. This mixture is marked *A*. An amalgam of zinc and tin with mercury is made, a slight heat being employed; and this is called *B*.

For every part by weight of alloy *A*, 0.12 to 0.025 part of mercury, or a quantity of the amalgam *B* containing this amount is taken, and well rubbed into the surfaces of the slabs, with a steel brush; thus producing an amalgam on the surface of the slabs. This operation is carried out at a comparatively high temperature, which, however, must not exceed that of the boiling point of mercury (675 deg. Fahr., or 352 deg. Cent.). It has been found that the amalgamation of the surface of the slabs by mercury alone is attended with difficulty; when, however, the zinc and tin amalgam is used, there is no trouble. The result is the same in both cases.

The slab with its coating of amalgam is then raised to as high a temperature as possible, in the absence of dampness; care being taken not to evaporate the mercury; and the heating is continued until the amalgamation is complete. This is ascertained by breaking the slab; the process is only complete when the slab is brittle. Another test is to permit the broken-off piece to cool for an instant in the air. If the amalgamation is complete, it will turn black; otherwise it will remain white.

The amalgamating alloy must be kept in a perfectly airtight vessel.

Where cost is an important element in the result, the amounts of mercury and tin (which are the two expensive elements in the matter) may be reduced. If it is a question of rapid development, then the amount of zinc or of tin, or of both, may be increased and that of the aluminium decreased. If quantity is required, the amounts of aluminium and zinc may be decreased.

If it is possible to make this alloy at a price which will permit the manufacture of hydrogen by its use in competition with the present existing processes, it would appear that the acetylene industries would suffer; as there would be absolutely no more danger from the bursting of steel cylinders.

Why a Girdled Tree Can Continue to Grow

TREES are girdled for the purpose of killing them. It has often been observed, however, that not all trees die immediately after they are girdled, but sometimes continue to live for a number of years. This is true particularly with young, thrifty trees having little or no heartwood. Large trees with thin sapwood will die at once if the latter is completely cut through to the heartwood. This can be readily explained on the basis that the heartwood is to all intents and purposes dead, and takes no part in the life of the tree except to support the crown. The sapwood, on the other hand, is the life of the tree, because it serves as the passageway for the sap in its ascent to the leaves. Therefore, as long as the sapwood is not completely chopped through to the heartwood the upward flow of the sap is uninterrupted, and the tree has a fair chance to live for a longer or shorter period after girdling. The sap goes to the leaves, where it is converted by special processes into plant food. As this manufactured food is carried down the stem it passes through the inner bark as far as the wound in the trunk. Above this point growth will be normal, and layers of wood will be deposited in the regular way. The stem below the cut fails to receive nourishment, because a complete ring of bark is removed and the passage of plant food between the leaves and roots is interrupted. Naturally, the tree will die in course of time from lack of sufficient root activity, which is out of proportion to that in the crown. Moreover, the sapwood is becoming narrower every year, and the passage of sap up through the stem is interrupted after it is entirely changed into heartwood.

Compass and Inclinometer for Aeroplanes.—Patent No. 1,097,925, to Henry L. E. Johnson, of Washington, D. C., provides an aeroplane compass and inclinometer for determining the direction, inclination and angle of the aeroplane.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

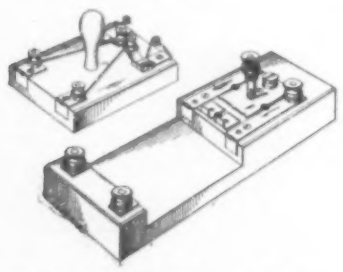
Pertaining to Apparel.

WARDROBE FIXTURE.—J. FORESTER, 458 W. 166th St., New York, N. Y. This invention relates to hangers or display devices, and has particular reference to means to be applied to the interior of wardrobes for supporting clothing or the like. By the term wardrobes as used herein is meant to cover any kind of closet for clothing or the like.

Electrical Devices.

TELEGRAPH REPEATER.—R. T. DAVENPORT, P. O. Box 561, Williams, Ariz. This invention pertains to a single line telegraph repeater, and the general objects are to increase the speed of transmission of telegraph signals repeated from one line to another; to improve and simplify the construction of the apparatus so as to be reliable and efficient in use, and to eliminate objectionable features in existing repeaters.

LINE PROTECTOR FOR TELEGRAPH AND TELEPHONE SYSTEMS.—T. GONZALEZ Y SEBASCO, 42 Industria St., Habana, Cuba. This invention relates to protector devices of the spark arrester type for telegraph, telephone or other electric systems, whereby the electric instruments are protected against high voltage charges accompanying thunder storms or other



LINE PROTECTOR FOR TELEGRAPH AND TELEPHONE SYSTEMS.

electric disturbances. The general object is to improve and simplify the construction and operation of lightning arresters of that type, including fuse wires or equivalent means so as to be reliable and efficient in use, and so designed that new fuses can be applied, even during the presence of a storm, without danger to the operator.

Of Interest to Farmers.

CHECK ROW PLANTER.—W. B. HAMPTON, 861 Phillips St., Springfield, Mo. Among the principal objects which the present invention has in view is the provision of means for separating the grains to be planted, whereby the same are more easily distributed than by the operation of machines as at present constructed.

PLANTING MACHINE.—L. B. MCNUTT, N. Kingsville, Ashtabula County, Ohio. This machine relates particularly to machines for planting seeds of various kinds, as for instance, for planting corn, and the object is to provide an improved mechanism for correctly dropping any desired quantity of seed at spaced intervals of any desired length.

SILO PACKER.—G. C. PARK, Selma, Iowa. This invention relates to a means for packing ensilage in silos and more particularly to a construction in which a packer device is suspended in the silo from the roof thereof, and arranged to be rocked vertically by an operator in the silo and to be raised and lowered, as well as turned about a vertical axis in order to variously position the packer elements in the silo.

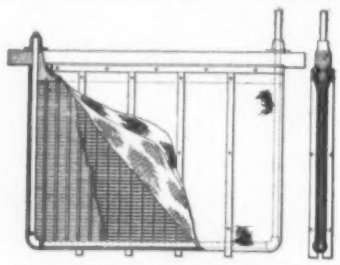
PLOW.—J. E. PEARCE, Austin, Tex. The present invention refers to plows for bedding and ridging plowed ground, the aim being to provide a construction in which a motor drive is especially adapted, without the necessity of means to pack loose earth in order to obtain the required resistance to the weight and power of the supporting driven wheels.

THRESHING MACHINE.—A. M. ANDERSON, Moscow, Idaho. This invention is an improvement in threshing machines, and the purpose is to provide a machine of the character specified, wherein means is provided for removing the heads from the stalk and for husking the grain immediately after the heads are separated.

Of General Interest.

SURGICAL APPLIANCE.—M. IVERSEN, 218 E. Main St., Stoughton, Wis. This invention relates more particularly to a fountain especially adapted for use in douching, and characterized by a construction to permit the flow of a given amount of a fluid in a given time or a large quantity of such fluid for the purpose of giving enemas or constituting a protoclysis apparatus. Mr. Iversen has invented another surgical appliance in which are a fountain can, a dropper, and a form of tube, the apparatus being characterized by the fact that gases may be returned without affecting the operation thereof.

LEAF OF VACUUM FILTERS FOR CYANID PROCESS.—Y. OHTSUKA, 66 Mita Toyookacho, Shibo, Japan. The inventor's object is to improve a defect by the new construction of a cocoa or plain mat used heretofore as a core, in which the vertical center rods



LEAF OF VACUUM FILTERS FOR CYANID PROCESS.

pass through from the bottom suction pipe to the head beam in the center of the leaf to form spaces along the rods for the passage of the liquid, so that the sucking action of the bottom suction pipe is distributed at once uniformly throughout the whole surface of the leaf, and the defective resistance for filtration of liquid is greatly decreased, by which the power of the pump may be greatly saved.

Hardware and Tools.

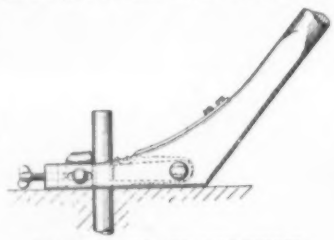
WIRE SPLICER.—H. B. BOTTNER, Marshalltown, Iowa. The purpose in this case is to provide a device especially adapted for use in weaving fences of wire, or in any other con-

WIRE SPLICER.

dition where it is desired to twist two wires together, wherein a twisting mechanism is provided for engaging the wires, so arranged that one wire will be held firmly while the other is twisted around the same, and wherein means is provided for automatically locking the first-named wire in position operated by the insertion of the wire.

WIRE LINE CLAMP.—J. H. KUHNS, Tulsa, Okla. The object here is to provide a clamp, wherein mechanism is provided for engaging the line at any desired point, and so firmly and rigidly, that the desired amount of traction may be made upon the clamp to draw the wire, without slipping of the clamp.

PIPE AND BOLT PULLER.—O. HENDRICKSON, Pinewood, Florida. The invention relates to a tool consisting of a handle member and a foot of an angle thereto, the latter being provided with gripping means for engagement with the pipe or other article to be pulled, the



IMPROVED PIPE AND BOLT PULLER.

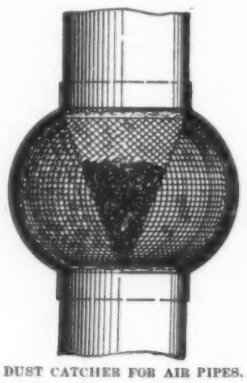
tool being rockable on the heel of the foot, to exert a lifting pull on the pipe. The invention provides a novel arrangement of gripping dogs so mounted as to exert an end thrust against a solid portion of the tool, provision being made for movement of the dogs for the engagement and release of the article to be pulled.

Heating and Lighting.

LOCKABLE COCK FOR GAS METERS.—E. A. C. SCHOOF, care of M. C. Berger, 475 Flushing Ave., Astoria, New York, N. Y. This invention has for its general object to improve and simplify the construction and operation of lockable cocks so as to be reliable and efficient in use, comparatively inexpensive to manufacture, practically tamperproof and yet easily manipulated and controlled by authorized persons.

ELECTRIC LIGHT PENDANT.—W. O. TEASDALE, care of Bureau of Public Works, Manila, Philippine Islands. The invention relates to improvements in adjustable electric light fixtures. An object is to provide a holder for an electric lamp by means of which the lamp may be easily adjusted to any position, and may be firmly held in its adjusted position.

DUST CATCHER FOR AIR PIPES.—J. W. YOUNG, care of A. Sohn, 128 N. Court Ave., Memphis, Tenn. This invention relates to a dust catcher especially adapted to be inter-



DUST CATCHER FOR AIR PIPES.

posed in an air conductor pipe of a hot air furnace at any point between the furnace and the register. It provides a dust catcher adapted to be conveniently placed in position in any way to be readily accessible for the changing of the dust-catching material when desired.

Household Utilities.

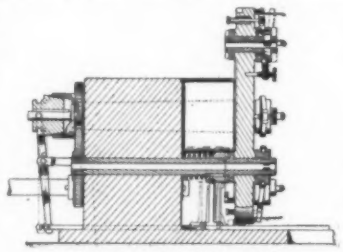
DOOR FASTENER.—T. C. DOREDANT, 1011 Marengo St., New Orleans, La. This device includes a shank provided with a locking head shaped at one side to project into and be accommodated in the door lock adjacent to the beveled end of the usual latch bolt, the head of the opposite side having a number to be projected laterally into the usual hole in the strike plate on the jamb by the turning of the device, there being a shoulder to engage the strike plate. Means provide for preventing surreptitious turning of the device out of engagement with the strike plate.

STAND.—N. NYBERG, Box 866, Miami, Ariz. This invention relates particularly to a stand in which the support is mounted to turn about the standard, and having a swivel connection with the latter to assume various angles with respect to the horizontal, or to be partially inverted for reading in a reclining position, or to be turned over completely if desired.

WINDOW.—F. L. RICHARDS and A. H. SHULL, Farmington, Minn. By means of this invention, the ordinary window frame, when originally constructed, may be modified at the outer portion to receive the storm sashes or screens, or in the case of window frames already in position, or made up conventionally, may be provided with an auxiliary frame to receive the interchangeable storm sashes and screens.

Machines and Mechanical Devices.

BOLT THREADING MACHINE.—C. VALE and T. C. MUNDY, 604 9th Ave., S.W., Roanoke, Va. This invention provides a device by means of which articles such as bolts may be accurately and quickly threaded. It also provides



BOLT THREADING MACHINE.

means for threading bolts comprising a revoluble face plate having cutters with means for automatically releasing the cutters at a predetermined time and means for revolving the face plate to bring any of the cutters into operative position.

SNOW AND ICE MELTING MACHINE.—A. WETTERVIK, care of Gust. Lindahl, Box 208, Iron River, Mich. This invention has reference more particularly to a machine of that type, including melting rollers containing the fire grates for holding the fuel whereby the cylindrical surface of the roller is heated for melting the snow and ice by direct contact therewith.

LIFTING JACK.—J. P. RENEKER, Logansport, Ind. This invention pertains to hoisting and has particular reference to lifting jacks of the screw type and adapted to be operated especially by power motors for lifting heavy weights such as locomotives and cars for the removal of wheels and trucks.

REMOVABLE VALVE FOR PUMPS.—C. W. HAWKINS, Bellport, N. Y. This inventor provides a pump with a removable valve, the valve being normally held in place in the core of the pump by bolts, connecting the valve with the core, straps being mounted on the bolts, and engaging the valve, and legs which extend from the core for preventing the pivotal movement of the valve relatively to the core.

Railways and Their Accessories.

AUTOMATIC TRAIN STOP.—W. E. LAWN, 1028 Granite Bldg., Rochester, N. Y. This invention has reference to railway equipment, and has particular reference to means for controlling automatically a running train when by inadvertence or otherwise the engineer of the train may have disregarded a danger signal.

Pertaining to Recreation.

MINIATURE PARACHUTE.—H. MANSON-OLIN, 414 Union St., Brooklyn, N. Y. This invention provides a device with a guiding tube in which a loosely mounted weight is positioned so as to guide the parachute in its upward travel and also its downward travel. It also provides a collapsible canopy and a tubular member connected therewith and co-acting with braces connected with the periphery of the canopy so as to limit the spreading of the canopy in its downward movement.

TOY CAR.— F. E. SEAL, 808 So. Braddock St., Winchester, Va. In the present patent the invention is a toy car having internal grooved wheels adapted to run on a single cord, wire, or rail, and whose center of gravity is below such wheels, so that the car is self-supported.

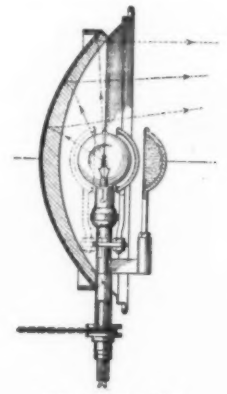
Prime Movers and Their Accessories.

CARBURETER.—D. MC RA LIVINGSTON, 34 E. 32nd St., New York, N. Y. The present invention provides an ample feed for low pressures, and prevents excessive feed or too rich a mixture, in response to increase of engine speed. Air inlets are provided in the nozzle at different levels, the inlets being liquid sealed under low pressures by the fuel, and unsealing at successive heights in response to increased speed, whereby to successively admit into the nozzle relatively increasing quantities of air.

SELF-GRINDING VALVE.—W. MAHONY, Hamilton, Ontario, Canada. This invention relates particularly to the valves of internal combustion engines and of the type generally known as puppet valves, having rotatable and longitudinally movable stems mounted in parallelism, it being the object to so connect the valve stems by gearing that they may be longitudinally moved by the usual cam tappets and rotation applied to one thereof will be communicated throughout the series.

Pertaining to Vehicles.

PROJECTING LAMP.—C. A. MATISSE and A. C. MATISSE, 511 E. 116th St., New York, N. Y. This invention relates to projecting lamps on vehicles for road illumination, and has reference more particularly to the type using a mirror lens. It provides a lamp of small depth and weight having two distinct brilliant fields of light without the use of a condenser, which not only reduce the bulkiness



PROJECTING LAMP.

of the lamp, but increase the lighting capacity of the same, as no light is absorbed by the condenser. One of the distinct fields of light can be eliminated when the same is in use in cities. All the above objects are obtained by providing a mirror lens, the reflecting surface of which has the shape of a paraboloid with a source of light positioned substantially in the focus of the said reflecting surface.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Strategic Moves of the War

(*Concluded from page 338.*)

hoyckt, and Lierre were reduced and were captured about October 5th by the assaults of the German columns under the protection of this fire. A lull in the attack then occurred, apparently to enable the Germans to move their heavy ordnance to the east. Next Forts Kessel and Broechem were similarly captured about October 7th, and the Germans advanced against the inner line.

The final abandonment of Antwerp by the Belgian garrison on October 9th seems to have been due to the admission of the French and British of their inability to render any appreciable aid. A garrison of determined fighters could probably have held the fortress for sixty days against the German attack; but the Belgian force, weakened in morale by defeats and by misfortunes apparently due to treason, had choice only of two alternatives. They could remain in Antwerp and suffer a siege with the certainty of capture before relief could come, or they could evacuate the city and save a part of their army to reinforce those of the Allies.

After consultation with their Allies they chose the latter, and they are now fighting in the effort to join the main line of the Allies on the French border. The Germans are making just as vigorous efforts to prevent this. From Lille and Ypres they are fighting to cut off the Belgians from the coast roads, while the victors at Antwerp are pressing hard on the Belgian rear.

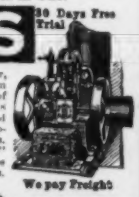
The capture of Antwerp is a very great advantage to the Germans. It relieves them of the threatening force on their flank that constantly endangered their line of communication; it shortens their general line of battle and allows them to hold it in greater strength; and it allows them to send the Antwerp army and part of the garrison of Belgium to reinforce their armies at the front. In prisoners, stragglers, and detachments interned in Holland, the Allies have lost at least 50,000 men, while the Germans have lost only the men killed or seriously wounded in the assaults. The capture of Antwerp means for the Germans more than a reinforcement of 50,000 men.

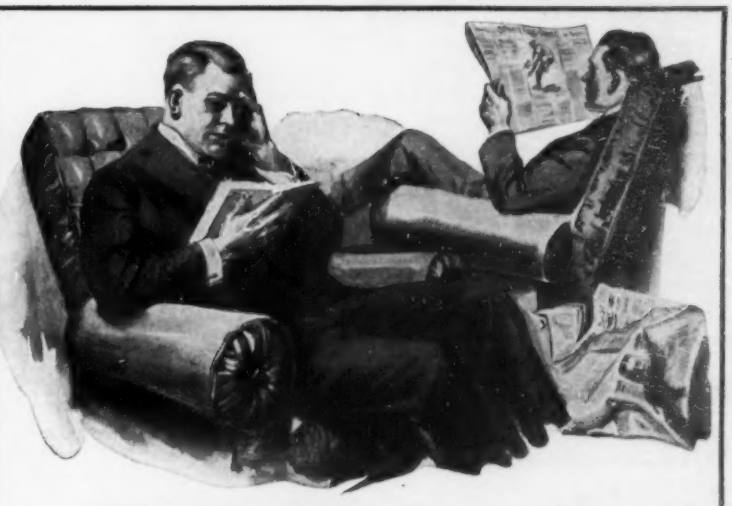
The week has been one of serious reverses for the Russian cause. In the north they have made slight gains and have occupied Lyck, while the northern flanks of the two armies are fighting at Wirballen, where the railroad from Kovno to Koenigsberg crosses the border.

The important fighting has been in southwest Poland, where the Germans have made an advance that influences the whole eastern campaign. When their General Staff saw that the army of Gen. von Hindenburg from East Prussia had succeeded in forcing the Russians back to the Niemen River they turned their attention to the question of relieving the hard-pressed Austrian army at Tarnow. Gen. von Hindenburg was directed to keep up his attacks on Gen. Rennenkampff's army, while the remaining German reserves were concentrated in western Poland to carry out their strategic move. The Russians discovered this projected attack and rushed troops toward Kielce and Tomaszow, but were unable to check the German advance. The former were forced back to Radom and Opatow, due south of Warsaw, where they received reinforcements and made a stand against the advancing Germans on October 4th.

Neither side has given out the details of this battle, but it was evidently a serious reverse for the Russians, who, though probably superior in numbers, were so decisively defeated that they abandoned southwest Poland to the Germans and retreated to the Vistula River. So much was the army in Poland broken up that the Russians had to abandon the important campaign against the Austrians in order to call in troops from Galicia to aid in checking the German advance.

The advance of the Germans was pressed toward the junction of the San and the Vistula rivers and so threatened the communications of the Russian army at Tarnow that it had to fall back rapidly. On October 9th the Russians evacuated





Rzeszow, and on the 12th their investment of Przemysl was broken. By this strategic move against the Russian rear, the Germans have accomplished in ten days more than could have been gained by a month of frontal fighting. Besides occupying Poland and forcing the evacuation of part of Galicia, they have gained a respite for the Austrians that will enable them to reorganize their armies.

By successful strategic control of their armies, the Germans have succeeded in pushing a wedge into Poland south of Warsaw, where they threaten to get between the two wings of the Russian army. The difficulties of this advance must have been serious and expensive in men and animals. They had only one railroad to aid them and but few paved roads for their automobile service.

In their new position the Russians should have every advantage in numbers and equipment. If they cannot stop the Germans in the battle that is raging they will be in danger of losing Warsaw.

A computation of resources and time for development of military strength indicates that the Russians appreciably outnumber the combined German and Austrians in this entire eastern theater of operations. The approximate strength of the armies at the front is 2,600,000 Russians against 2,000,000 Germans and Austrians. Success in battle, however, depends upon more than numbers, as was shown by the campaign of the Japanese in Manchuria in 1904 and 1905, when they successively forced superior numbers of Russians to retreat from Liaoyang and from Mukden.

The victory at the point of fighting depends not upon the total strength of the opposing armies, but in the strength that they are able to get into the fight, and the ability of the commanding generals. The commanding general has little information of the enemy's plans, and most of his information is inaccurate. He must guess the plans of his opponents and must make his dispositions to defeat them. The efficiency of his organization also counts greatly; he must be able to put every man possible into the firing line, and yet be able to get them back in hand to be moved to another position if required by the development of the battle. This is where thorough training and practice in maneuvers count in the chances of the army for victory.

Our 8,000 Islands

ACCORDING to a report recently received by the National Geographical Society the United States now owns exactly 8,000 islands, supporting a population of 10,000,000. The report further shows that the commerce of these islands exceeds $300,000,000, or more than that of the United States in any year prior to 1850. American capital invested in the islands aggregates approximately $400,000,000, and from them there is shipped to the United States $100,000,000 worth of products every year, and they take in exchange products of about equal value.

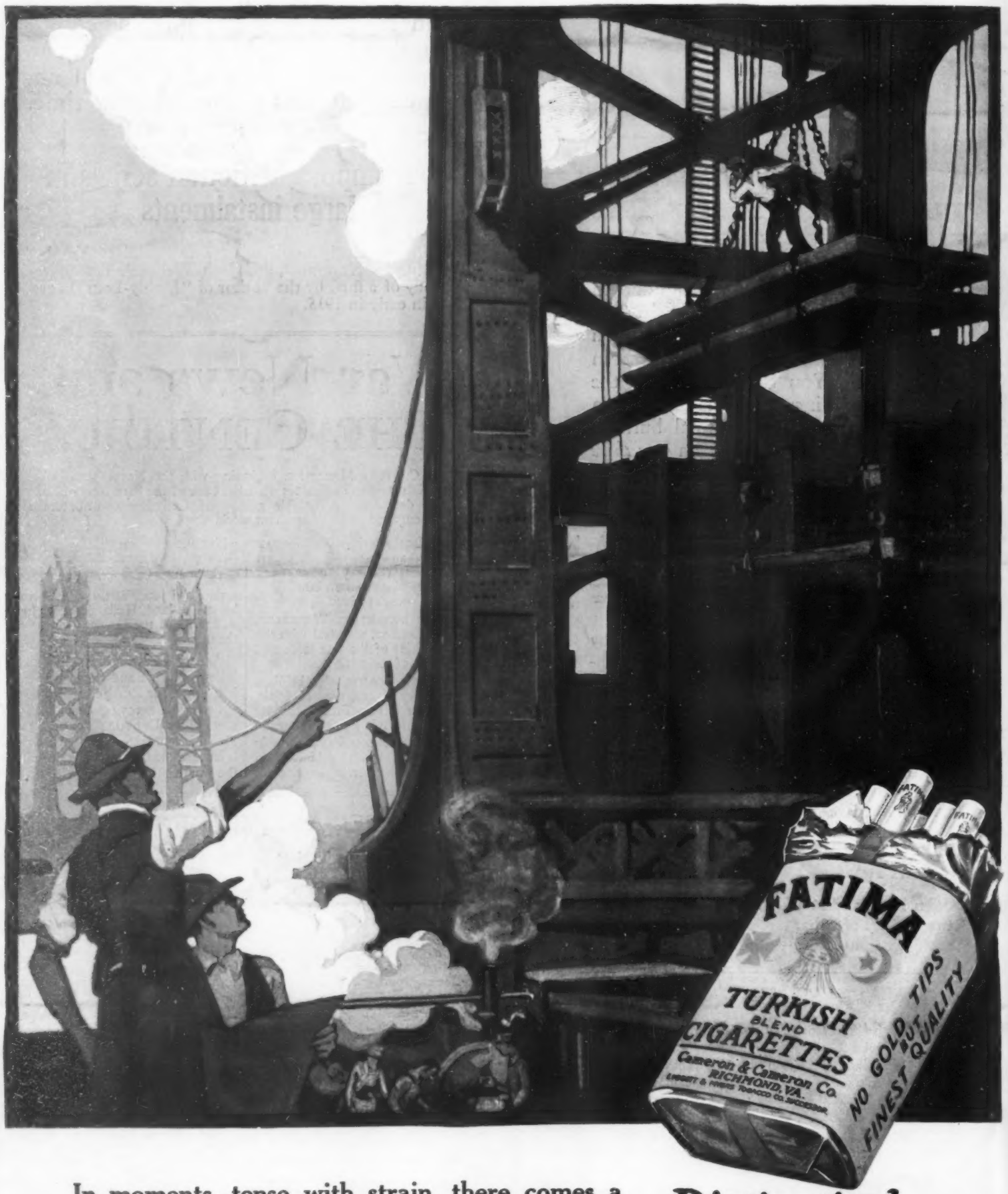
The feature of the report is the development of Porto Rico, Hawaii, and the Alaskan Islands. There were 25,000 pupils enrolled in the first year of American administration, now there are 175,000. Production of sugar has grown from 65,000 tons a year to 365,000. Foreign commerce was about $20,000,000 a year; now it is nearly $100,000,00.

Hawaii has been extremely prosperous since it came permanently under the American flag in 1900. The assessed value of the sugar crop more than doubled, deposits in banks trebled, and in savings banks quadrupled. Hawaii's irrigation system is the marvel of the engineering world, and the quantity of sugar produced per acre far exceeds that of any other spot on the globe.

"The Alaskan islands and mainland," says the report, "cost us $7,500,000, an expenditure that many believed to be unjustifiable; yet for many years the annual value of seal skins alone approximated the cost of the entire area. At present the value of the canned salmon sent us from Alaska in a single year is twice as much as the entire possession cost."

FATIMA

THE TURKISH BLEND CIGARETTE



In moments, tense with strain, there comes a time when relaxation's needed. What better fills this need than a Fatima, the distinctive cigarette?

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Distinctively Individual

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